SMALL WATER-POWER PLANTS

The ELECTRICAL REVIEW

FOUNDED 1872

Vol. CXII
No. 2876

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JANUARY 6, 1933

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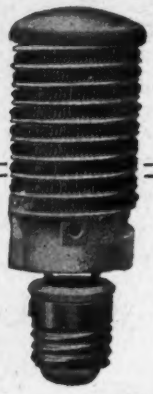

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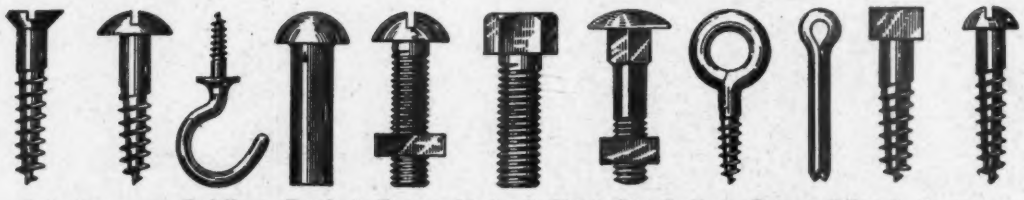

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GUARDS

The
Electrical Review

VOL. CXII. JANUARY 6, 1933. No. 2876

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Distribution Year

THOUGH "to-morrow never comes," "next year" in the grid sense has arrived, and trading operations under the Central Electricity Board have begun.

For months past many of us have been thinking very seriously about what would happen to force the distribution pace throughout Britain in 1933. It is not our intention to indulge in retrospect, save to express satisfaction that the aggregate consumption of electricity has made progress in spite of unparalleled trade and economic depression. Yet we may, in passing, imagine how much larger would have been our output if the wheels of industry had been running at full speed.

There are signs here and there of revival in our normal industries, and we hope that during the coming months the movement will gradually gather force. The new factories that have been and are being established will add to the demand for industrial electricity as well as for general equipment, and they should absorb a fair number of our unemployed population, thus increasing their spending power.

Every one of our readers will join with us in hoping that the prophecies of the eminent that this year will see us well on the way toward relief from some of the burdens that now oppress us may be fulfilled. Three small indications of improvement are to be found in the larger retail trading of the recent Christmas season at the stores, a greater activity in house building of the smaller class, and better business in small motor cars. Leaders of the coal, iron and steel, electrical engineering and other trades have spoken—though cautiously—of signs of revival.

The increasing adoption of electrical illumination on effective lines for exteriors in all big cities and towns is adding to the supply load, to the contractors' order book, and to the sales of lighting equipment. But, when all these and other such signs have been thought of, there remains the one great department of domestic electrification which bids fair to eclipse them by its constantly increasing contribution to the work of electrical development.

With this thought before us we go forward into what we have in the title of these notes described as "Distribution Year." In various parts of the country plans are being laid by engineers and managers to provide facilities for those who are at present deprived of them. Thousands of miles of distributing cables and lines will be laid this year and tens of thousands of new consumers now waiting for supply will provide orders for transformer equipment, switchgear, and other work for the electrical industry if we face the situation boldly and consistently apply ourselves to the duty of loading up the grid.

We trust that it will be our duty to record every week new and substantial additions to the outlays of undertakings which have not hitherto adopted a truly progressive policy.

If all undertakings will either co-operatively or individually make the move forward in this direction that is warranted the electrical industry will have little reason to look back with regret upon 1933.

Hats Off to Philadelphia!

MORE than ordinarily interesting is a recent leading article in the *Electrical World*, announcing the award of a medal by a leading newspaper owner to one Horace P. Liversedge, and its presentation to that gentleman before a great company of electrical men and women in Philadelphia. Who is Mr. Liversedge, winner of such great popularity? He is the president of the Electrical Association of Philadelphia and a vice-president and general manager of the Philadelphia Electric Company. But what has he done? Having looked almost in vain for new strong men to give our own industry a lead, we quote almost with envy our contemporary's words: "He has led the electrical men of that community out of discord into unity of purpose." "He is one of those rare spirits who has had the imagination, the vision, the courage, and

the genius to go forward and do things that should be done, where other men have failed or been afraid to try." Silently we weep here in admiration—we remember many attempts of the same kind by our British brethren to stimulate progress toward "co-operation in the electrical industry." As we read on we find that Mr. Liversedge succeeded because he first understood his job. But—here's the rub!—he found that the greatest single obstacle to co-operation in the electrical industry (U.S., of course) was the fact that in so many cities the chief executives of the power companies did not personally participate in co-operative work! Will anyone dare say this of old England or even of Scotland? We congratulate Mr. Liversedge not only on his achievement, but also on its recognition. "He has made the electrical business not only more profitable to dealers, contractors, wholesalers, and manufacturers (note the order!), but has given them a healthier and happier atmosphere to work in."

New Year Honours

"THERE are no snakes in Iceland!" Was there ever a Birthday or New Year's Honours List in which the electrical profession and industry were more completely ignored? We cannot ascribe the omission to lack of achievement in the electrical field—see what great things have been accomplished! Rather must it be that the halo of modesty that adorns many an electrical brow is considered honour more than enough for mortals to carry! Peerages, baronetcies, knighthoods—vanity of vanities!—let us get on with our work of shovelling the load on to the grid!

Lessons from Sweden

AN investigation into the working of the Stockholm-Göteborg electrified railway has resulted in a decision by the Swedish Government to change over a further 990 track miles from steam operation. The lessons we may learn from Mr. T. Ofverholm's I.E.E. paper last night are the financial savings accruing from electrification, the great increase in, and speeding up of, traffic, the improved reliability, and the improved operating conditions of the national grid. Sweden possesses water power, but the quotation for electricity was originally less favourable than the figures put forward in the Weir report, and coal in Sweden has been as low as 16s. per ton. Sir Hugo Hirst, Bt., in a letter to the Press, deprecates the counsel of despair indicated by the clinging to steam for British main lines. Electrification of suburban systems is generally accepted as correct, owing to their high traffic density, but the density, as Sir Hugo points out, is little greater than on a considerable mileage of our main lines.

Electricity in Gas-works

GAS-WORKS are not usually regarded as good consumers of electricity. Yet from some statistics recently published by the Board of Trade it appears that nearly 40 per cent. of the horse-power used in the production of gas is electrical; in 1930 64 million kWh was required, one-quarter of which was purchased. The inference is that our principal competitors have a keen appreciation of the value of electricity in efficient production, as the proportion of electrical plant in gas-works has considerably increased during the past few years. The bulk of the electricity used was presumably produced by gas-engine-driven generators, but the original source of the supply of electricity is immaterial; what counts is the preference for electricity as the most convenient method of transmitting power from the prime mover to the point of application.

The Smaller Undertakings

ONE of the most momentous questions confronting the electrical industry is the ability of small undertakings to develop their areas adequately. Does the physical limitation imposed by their scale of operations present an insuperable obstacle to their pushing the sales of electricity, hiring appliances, and giving expert advice and good service to consumers? A letter in this issue from Mr. James Scott, engineer and manager of the young Carrickfergus undertaking, indicates what initiative and resource can accomplish in a town of only 7,000 inhabitants. Last week we reported the achievements of Lt.-Col. H. W. Watts in the domestic field at Epsom, and on September 16th we commented upon the enterprise shown by Mr. A. J. Hutchinson at Farnworth (Lancs)—both towns with less than 30,000 inhabitants. Much depends upon whether the small local authorities are prepared to pay the right men to direct what should be rapidly developing enterprises, and also the necessary assistants skilled in various ways for dealing with different classes of consumers. And let there be no more nonsense that, because the power-station has been closed down in favour of bulk supply, the manager of the undertaking is worth less. He should be worth more. Will he commercialise himself so as to become so?

Heavy-oil Engine Costs

THE annual report of the Diesel Engine Users' Association by its frank presentation of working results has done much to increase the value attached to the heavy-oil engine. It has also given pointers to the direction in which improvements lie. Thus, from the latest report we can ascertain the appreciable reduction in operating costs that result from an increase in average unit capacity, improvements in design making for ease of maintenance and operation, and the use of the most suitable lubricating oil; care in the choice of the latter has reduced fuel consumption, and, in one case, reduced liner wear by one half. Supercharging, as at Ashford, is a development that seems to be working out well. The installation of a small, unattended power-station in Scilly exemplifies the reliability of the modern oil engine. But it is in the increased engine capacity that we must look for the most promising developments, and further results from the 2,300-h.p. six-cylinder engine sent to Bermuda by the English Electric Co. and set to work last year will be awaited with interest.

Plain Speaking

THERE is a certain liveliness in our "Correspondence" pages this week. After the invitation that we gave in our last issue to young electricity supply men we, of course, welcome it. The free expression of opinions concerning matters that vitally affect the personnel of this branch of the industry may serve to open the eyes of readers to the peculiarly difficult position in which so many of the younger men find themselves to-day. We shall return to the subject later.

Spare Boiler Capacity

WE hear a good deal from time to time of the disproportionate amount of spare plant in our generating stations. The gradual reduction of the margin necessary to safeguard continuity of supply is one of the major advantages to be expected from grid interconnection. This margin is usually expressed in terms of kW capacity of engine-room plant, but in many stations, even modern ones, there is yet more spare capacity in the boiler-house. This seems to indicate a lack of confidence in the reliability of boilers as compared with turbo-alternators that is a relic of the days when long runs between adjustments were not to be expected, but to-day, even with difficulties due to air-preheating, boilers are in continuous operation for periods that would not have been thought possible even a few years ago. There appears to be no co-ordinated information on the subject in this country, but opinion in the United States seems to be that modern steam generators can be relied upon for well over 80 per cent. of the time, and that the percentage is tending to grow. A reduction in spare-boiler capacity may prove to be one of the uncovenanted benefits of the grid.

Electricity in the Elephant and Castle Theatre, London

1. Proscenium and organ lighting. 2. Box-type fittings in the auditorium. 3. Cinema-projector and sound control equipment. 4. The operating box; dual control panel in the background. 5. The entrance vestibule. 6. Attractive foyer illumination.

D

The Elephant and Castle Theatre

Outstanding features of electrical interest

FROM the electrical point of view the new Elephant and Castle (London) Theatre is of much interest, not only because the major services are electrical, but because there are several novelties which have been introduced. Supply is taken at 400 V three phase from the London Electric Supply Corporation, Ltd., and the front and back intake and distribution chambers are notable for the neat and compact arrangements of "M.E.M." and "Walsall" ironclad switch and fuse gear respectively, within very limited space.

Stage Lighting

The stage is served by two 35-ft. multi-colour battens and a similar line of footlights, each equipped with about sixty 150-W lamps, as well as two 1,000-W spot-lights and four 1,000-W portable stage floodlight projectors, all made by Beard, Ltd. Dual control for the footlights and battens is arranged from the dimmer panel on the stage and a dead-front board in the operating box or projector room under the balcony. Electrical curtain control equipment was supplied by the Electric Control Co., Ltd.

An unusually attractive three-colour and amber trough system of proscenium lighting is served by a specially designed motor-driven automatic blending equipment.

Projector Equipment

In the operating box there are two projectors, with Ross mechanism and arc lamps on Western Electrical universal bases, as well as a combined spot and slide lantern and a multi-coloured spot lantern for stage effects. It is believed that the special system of Western Electric sound equipment is the first of its kind to be installed in London.

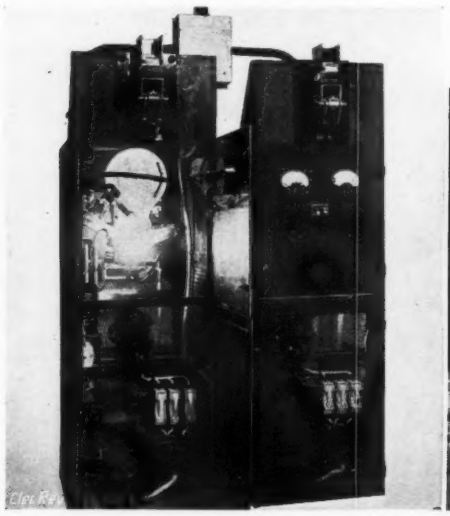
There are two amplification systems, one of these being the stand-by, which can also be used for relaying music to waiting-rooms, &c. It is also possible to amplify speech by microphones on the stage and loud speakers in the proscenium arch. The organist can also make announcements through these speakers.

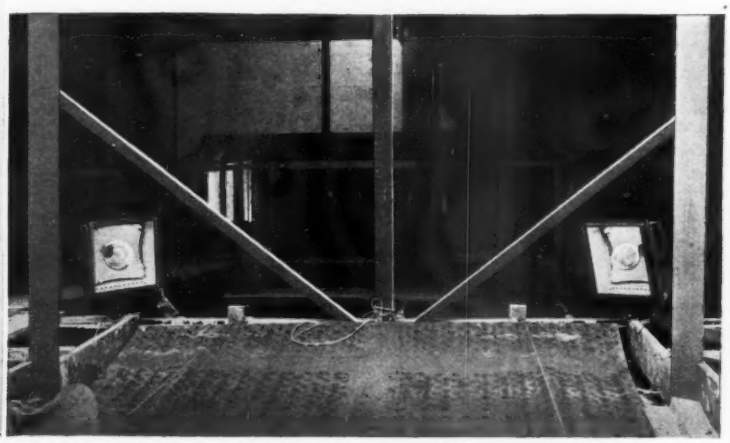
All the sound equipment was supplied by the Western Electric Co., and it will be appreciated that normal utilisation of the stand-by panel avoids considerable "idle capital." Each of the projectors is supplied by two 110-V, 150-A d.c. Hewittic rectifiers, which can be paralleled to give a single 300-A output. The projectors are supplied with three-phase current.

Main Lighting

A large central laylight in the roof can afford daylight or artificial lighting at will. Four 1,500-W flood lamps above it provide a wonderful interior effect by virtue of "golden ribs" suspended beneath the laylight. Most of the main lighting fittings are of the box type with coloured glass and were supplied by Mr. F. H. Pride, who also manufactured the unusual fan-shaped wall fittings from which light is "splashed" upwards from lamps concealed in the fan pockets.

Secondary lighting is supplied by a 120-Ah, 100-V battery supplied by Britannia Batteries, Ltd. This is arranged on the floating principle with an "E.C.C." 5-h.p. charging motor-generator—a compounded machine which carries a short-circuiting switch to cut out the series winding when on charging duty. The battery control board carries two "Salford" automatic-reverse cut-outs.





Left: One of the Hewittic rectifier equipments at the Elephant and Castle Theatre. Right: The method of illuminating the central laylight, showing two of the 1,500-W floodlights

The battery consists of forty-eight sealed stationary cells, type "SLH5," having a capacity of 125 Ah at a ten-hour rate of discharge, and is erected on two double-tier stands of improved design with no metal fastenings of any kind. The positive plates are of the heavy Planté type, 12 mm. thick, and the negative plates are of the box type, 8 mm. thick, while the separators consist of specially treated wood diaphragms and ebonite supporting rods. Adequate space for sediment is allowed beneath the plates so that the cells need not be cleaned out until the plates are renewed.

Some particularly attractive neon lighting, including the Elephant and Castle sign, on the front of the building was supplied by the Pearce Sign Works, while arresting canopy and outside floodlighting should be mentioned.

We are indebted for help in collecting this information to Messrs. W. Draper & Co. (Electrical Installation), Ltd., who not only carried out the whole of the installation work, but also designed much of the equipment, including the canopy and outside floodlighting, and the dimmer control gear and panels.

Opal Diffusing Glasses

IN a paper read at a recent joint meeting in London of the Illuminating Engineering Society and the Society of Glass Technology, Messrs J. W. Ryde and B. S. Cooper developed a theory of and outlined a specification for opal diffusing glass. The agreement obtained experimentally between calculated and measured values was claimed to be sufficiently good to justify the use of their method of calculation over the range of values of lighting fitting wall thickness likely to be met with in practice. Their method of calculating the value of the absorption co-efficient, or light output ratio, at any thickness should prove to be of value in the design and testing of illuminating ware.

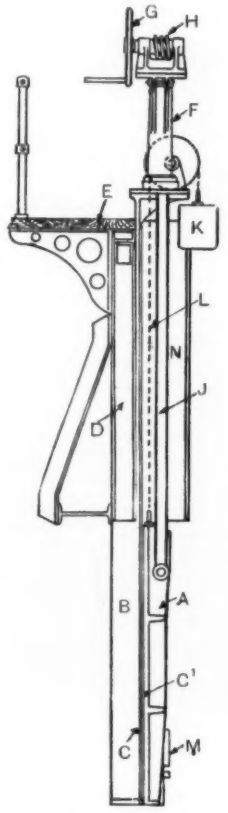
The paper was based on work which is being done at the G.E.C. laboratories, Wembley, and it has dovetailed perfectly with investigations carried out at the National Physical Laboratory, Teddington, for the British Standards Institution's Sub-Committee ELG/3/2 on Light-diffusing Glass (a résumé of whose work was given to the meeting by Dr. S. English). The Committee states that two of the principal items of any specification drawn up must be (1) filament non-visibility and (2) minimum luminous efficiencies for globes or spheres under specified conditions. If a globe or lighting fitting is satisfactory in these respects, then several other properties (such as, for examples, light diffusion) are necessarily satisfactory. It is the hope of the Committee that when the new specification is ready, it will be found acceptable and useful to both the glass-maker and the illuminating engineer.

A paper contributed by Dr. W. M. Hampton, head of the research department of Chance Brothers & Co., Ltd., dealt with some aspects of the manufacture of opal glass.

Small Hydro-electric Plants. By F. J. Taylor

Possibilities worth consideration

THE Merthyr Electric Traction Co. has two little hydro-electric plants on the Taff, one of which has been put into operation this year following the success of the previous one installed in 1928. They are situated in the centre of a large coal-producing area and show a profit to the owners; they serve to demonstrate that these small schemes can prove a sound investment. The machinery, power for power, may be cheaper than a steam or oil-engine plant. Small hydraulic turbines are essentially simple rugged machines which can be remote controlled from a main station. Maintenance costs are small and attendance charges may be negligible; it is the cost of the incidental works which largely determines the ultimate profit or loss.



A simple cast-iron sluice

A, gate; B, frame; C.C1, bronze sliding faces; D, platform support; E, platform; F, hand-wheel pillar; G, hand-wheel; H, worm; J, gate-lifting rod; K, counter-weight; L, counter-weight chain; M, wedges; N, counter-weight guide.

The simplest conditions are those of a mountain stream where, from a simple intake, the water can be piped to the power house with a fall of perhaps 500 ft. within a mile or less to operate Pelton wheels. This class of turbine calling for no expensive foundations or "settings" is as easy to install as a centrifugal pump. At the other end of the scale is a slow moving river calling for an extensive barrage and giving no more than 20 ft. fall, reduced at times by flood water. Rarely can such sites be developed economically for less than several thousand h.p., but when water is found to be available to the extent of 50 h.p. or so, the possibility of using it is always well worth looking into.

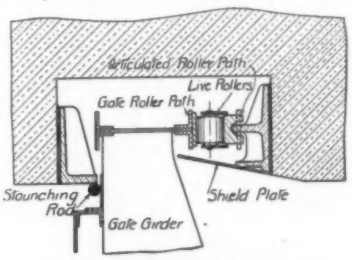
Storage Schemes

Only in exceptional cases would it be politic to create appreciable storage, unless the water flowing through a deep and narrow valley could be impounded by a small concrete dam. At low falls, where storage is costly, the turbine can be used to pump back water into a high-level reservoir for delivery to a high-head turbine. This system has been extensively developed in Central Europe, where natural lakes form convenient reservoirs; a small scheme of this kind is to be seen at the Walkerburn Mills on the Tweed. In the absence of an existing weir or natural fall, the simplest arrangement is that of a couple of sluices, ample in area to let off flood waters, damming back the water to about 20 ft. According to the levels it should be possible to get another 20 to 30 ft. of fall by means of the head race and perhaps another 10 ft. in the turbine draft tube. That is to say, under comparatively unfavourable conditions, a carefully selected site might provide 50 ft. of fall, which is a fair working value for a small turbine.

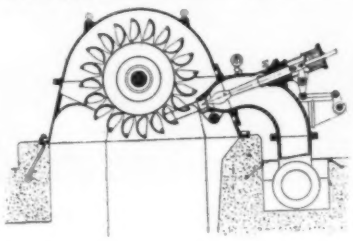
Increasing the Head

An existing barrage or weir providing, say, 20 ft. of fall, may be increased by means of sluices or even flash boards set on top of the weir. Turbines can be operated on 20 ft. fall or less, but the plant as a whole becomes more costly with decreasing fall and the turbines are slow running cumbersome machines for their output. To build a weir is not as a rule to be recommended, as it raises the flood level along with the normal level; a sluice barrage usually serves the purpose better. A simple cast-iron plain-faced sluice with bronze-faced machined sliding surfaces and a counterbalance is durable and inexpensive. Stock patterns are usually obtainable from waterworks ironfounders.

The size of this class of sluice is limited and it may be preferable to install a couple of roller sluices of the Stoney type which can be made deeper and wider than a plain-faced sluice and yet be easily operated by one man. Several types are available from such firms as Ransomes and Rapier and Glenfield and Kennedy in which the thrust of the gate is transmitted to the frame through a series of free rollers and an articulated roller path, which practically eliminates friction in raising or lowering the gate, while the vertical staunching bars maintain water-tightness.



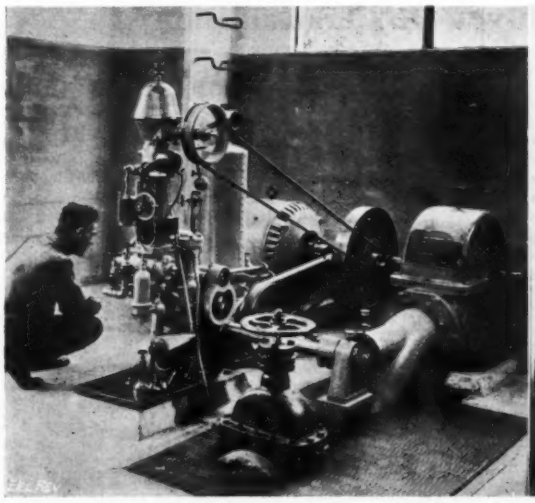
The Stoney roller sluice



Interior of Pelton wheel

An automatic tilting weir is used on the Falls of Clyde plants. In its simplest form the tilting weir is a hinged and balanced flap that is vertical at normal water level. At full flood the gate may reach the horizontal; usually it is balanced somewhere between the two. Counterbalanced roller sluices can be released automatically by means of a float-controlled trip gear, though such refinements are rarely called for on small works. The main point is this: if means are adopted to create head and/or storage by damming back the water, it is imperative to provide facilities for letting off floods, for which purpose a sluice along the bed of the river is preferable to a weir.

Good general values for high, medium, or low falls are heads



Pelton wheel installation; governor on left

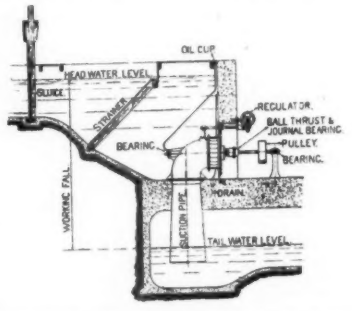
Single-discharge cased Francis turbine

of under 50, 50 to 200 ft., and over 200 ft., respectively. A fall of more than 200 ft. in a mile would provide a practical scheme at low cost. At 200 ft. head 2½ cusecs are roughly the equivalent of 50 h.p., which with a velocity of 10 ft. per sec. is within the capacity of 9-in. pipe, allowing for friction and internal corrosion. In average country a cast-iron or steel overground pipe is a straightforward job. Steel is lighter and may be cheaper than iron, it is not so easily fractured, it is easier to transport, and there will be fewer joints, though it is more liable to corrosion. That may be an important point if the water is acid-laden, as when coming from moorlands. A simple bell-mouthed concrete intake with a trash rack is all that is required at the head of the line except a valve—automatic if a burst could do appreciable damage—a standard production of waterworks ironfounders. Another valve contiguous to the power house and the pipe can be connected to the turbine or a bus pipe if there is more than one.

The majority of Pelton wheels are governed by gear consisting of a deflector which, cutting into the jet, deflects some of the water from the wheel; meanwhile the needle valve closes and adjusts the amount of water. This done the deflector becomes again inactive but always ready to move towards or away from the jet according to load conditions. This system is probably the best yet devised for Pelton wheels, but it is relatively costly. Cheaper systems are suitable when close speed regulation is not required. By far the greater number of small plants with a working head of over 150 ft. are operated by Pelton wheels. The Francis turbine is hardly likely to show any advantage, but under relatively high heads the cased single-discharge Francis turbine is almost as compact as a Pelton wheel. It may be more efficient and even cheaper, though high-head conditions really favourable to the Francis turbine are not often met.

iron, but the essential oil-pressure governor is a comparatively costly and delicate piece of mechanism.

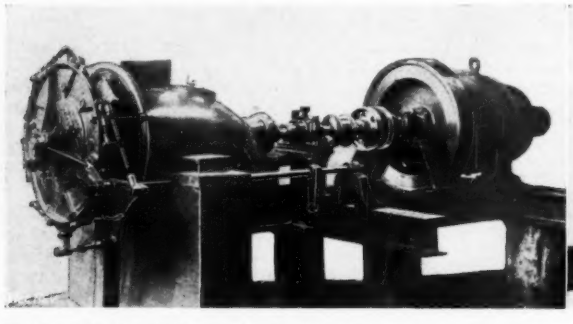
For a low fall, if ample water is available, a barrage impounding water five or ten feet may be quite simple. Probably the most important point is the risk of reduced fall in flood time due to backwater. Vertical-shaft Francis turbines can operate fairly well on falls as low as 10 ft., but the propeller-type turbine is generally better.



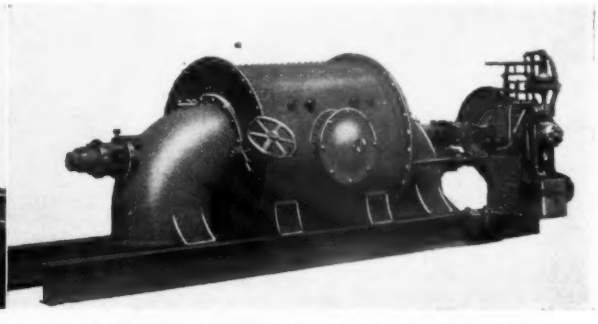
General arrangement for Gilkes horizontal turbine

The draft tube of a propeller-type turbine is very important because a large proportion of the head may be due to suction which has an influence on the working of the machine as a whole. The governor through mechanism at the top and a spindle in the hollow driving shaft can alter the angle of the four blades in unison with the gate opening. This is the essential feature of the Kaplan turbine, which in several large units recently built shows a high efficiency on a variable fall. This comparatively costly turbine is not so attractive for small units as the simpler fixed-blade Lawaczeck class of runner. The latter usually has six or eight blades of short stiff section inclined downwards while helical runners of the Prasil class are suitable and can be run at relatively high speeds.

The speed of these vertical-shaft low-fall turbines rarely exceeds 200 r.p.m., and is more usually about 100 r.p.m., requiring a comparatively costly and specially designed generator, but a bevel drive can be arranged to give speed increase to suit a standard design of generator. To aim at the high efficiency—often over 90 per cent.—of the large hydro-electric units by specially designed and delicately adjusted equipment is not worth the extra cost, but it certainly is worth while to investigate the possibilities of potential water powers, because the power being usually available 24 hours of the day is useful for assisting peak loads and carrying light ones.



Single wheel discharge type Francis turbine; governing mechanism on left

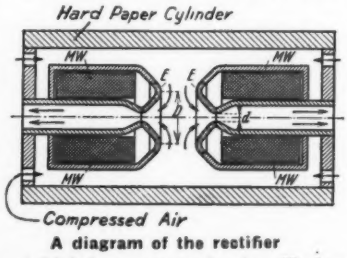


Two Francis wheels in one casing for 40 ft. head

There are at least twenty different ways of arranging a Francis turbine, but the principles of construction, operation and governing are identical in every case. Surrounding the wheel are guides which are opened or closed on the louvre principle by a ring operated by the governor. A Francis turbine in any form can work with a suction head up to about 18 ft., whereas with a Pelton the water simply falls away into the pit, the distance the wheel is above the latter being so much lost head. The Francis turbine is a simple machine with nothing to go wrong; it is mainly constructed of cast

A New Rectifier for High-voltage Transmission

THE arc rectifier shown diagrammatically in the accompanying illustration, reproduced from an article by Erwin Marx in a recent issue of *Elektrotechnische Zeitschrift*, is claimed to be suitable for continuous operation with heavy currents and at very high voltages, thus rendering practicable the use of d.c. high-pressure transmission lines capable of dealing with six or seven times the power that could be transmitted as three-phase a.c.



A diagram of the rectifier

The action of the valve is as follows: An ignition spark is produced periodically between the electrodes E by means of an auxiliary e.m.f. which may be derived from a coil connected in series with the rectifier and coupled inductively with an ignition circuit. A high-frequency train of oscillations may be initiated periodically in the latter by means of a rotating spark gap, the stationary contacts of which can be displaced to vary the timing of the ignition spark between the electrodes E. The ignition spark is followed immediately by a power current arc, which must be kept in motion so that the electrodes are not burnt, yet must be of nearly constant length while the current is flowing, otherwise the arc voltage and losses will vary.

The magnetic field of the coils MW causes the arc to rotate about the axis of the electrodes, meanwhile moving in towards the latter under the influence of the compressed air blast represented by arrows in the drawing. The ignition spark strikes between the nearest points of the electrodes, and conditions are so arranged that the ends of the arc reach the necks of the electrodes shortly before the current passes through zero. The air blast is here of maximum intensity and drives the ends of the arc into zones whence re-ignition is impossible. At the same time, the arc channel is powerfully cooled.

It is claimed that valves of this type have been tested up to carrying capacities of 1,500 A, combined with ability to withstand 150 kV during the reverse cycle; and that there is no reason why these values should not be increased. The efficiency of the device is between 98 and 99 per cent. The six-phase connection of a group of six such rectifiers provides a pulsating d.c. which shifts from one valve to the next with absolute regularity. The same arrangement can also be used for inverted (d.c.-a.c.) operation by merely altering the timing of the ignition spark. The cost of the equipment is said to be almost negligible compared with that of the rest of the transmission system.

Transformer and Rectifier Developments

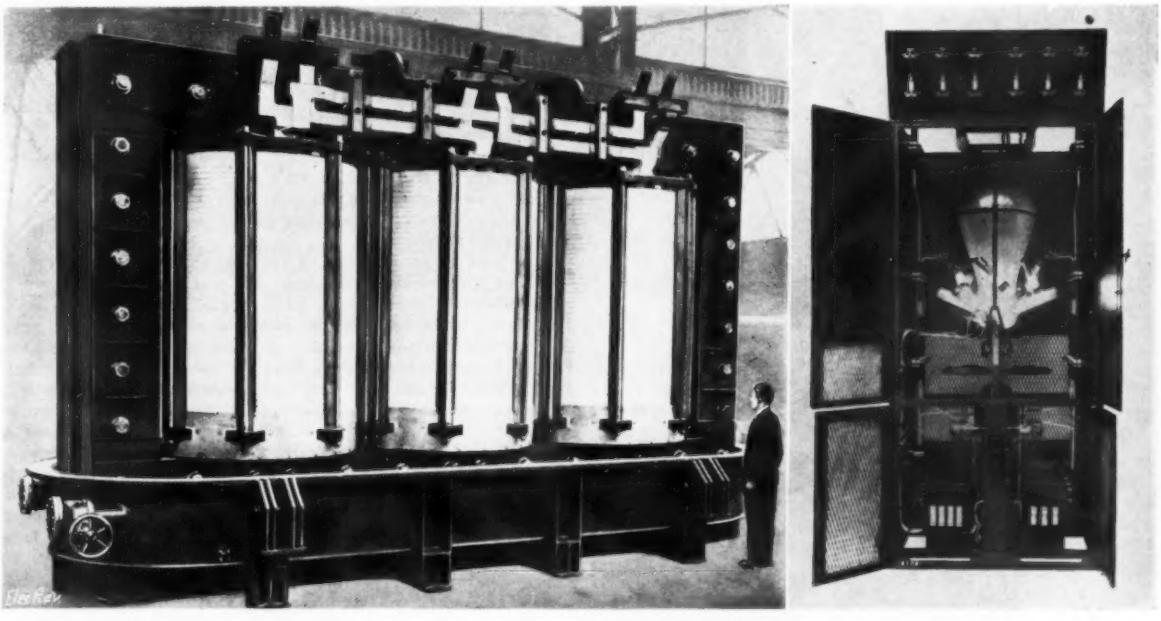
DURING a recent visit to the works at Walton-on-Thames of the Hackbridge Electric Construction Co., Ltd., and the Hewittic Electric Co., Ltd., we saw several new equipments which represent considerable technical or constructional advances. Among them was a 1,755-kVA transformer designed for use with a 1,500-kW glass-bulb rectifier which has its secondary winding arranged for a twelve-phase output or for two six-phase supplies. Designed specially for use with dust precipitation plant, a transformer of about 10-kVA capacity has a 60,000 V secondary winding, although the construction is quite standard.

For on-load tap-changing a 2,500-kVA, 33/11-kV transformer has an overall regulation of ± 10 per cent. in 2 per cent. steps. It can be operated completely automatically or by hand. A specially designed transformer for furnace work has an output of 7,500 A at 5 V. Voltages ranging from 5 to 250 can be provided by rearranging the busbar link connections to give various series-parallel combinations of the secondary coils. A transformer for direct burial in the ground has a cast-iron tank instead of the usual boiler-plate.

A coil for one of the 93,750-kVA transformers for Barking B station was seen being wound on a lathe with its own motor and reduction gear. Taped strip conductors are fed from spools on to the coil, and are insulated by hand with Empire tape and bound during winding. The coil is clamped together by eight tie rods and two cast non-ferrous rings, the latter being split before the coil is assembled on the core leg. The core is of five-limb construction and weighs 80 tons, the two outside limbs serving to reduce the height of the yoke.

Among the rectifier equipment under production in the Hewittic section were some sets for the Liverpool-Southport and Manchester-Bury lines of the London, Midland and Scottish Railway. For the former line there are two 2,000-A, 600-V equipments each made up of eight bulbs and one main transformer. Each equipment will serve in a separate sub-station. For the Manchester-Bury line there are six equipments for two sub-stations, three sets in each "sub." The rectifier groups are each made up of six bulbs and one main transformer, having an output of 1,000 A at 1,200 or 1,500 V. All these traction equipments have to stand very severe overloads, and the stipulated ratings are: nominal full load, continuous; 1½ times full load, two hours; twice full load, ten minutes; and three times full load, peak periods of a few seconds each.

Although the full scope of the grid control of rectifiers has been far from realised yet, the company has already supplied several units so equipped for service. Converting to 20,000 V and above represents another interesting field of rectifier development, and 1,000-kW bulb units for such voltages are being made; further, the company anticipates making soon bulbs of even larger outputs for higher pressures.

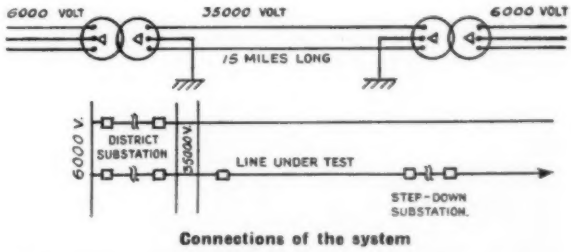


Left: The core assembly of a 93,750-kVA transformer from the l.p. side. Right: A Hewittic rectifier cubicle (L.M.S. Railway)

An Earth Phase

AN experiment recently carried out on one of the 35-kV lines of the Leningrad Electric System is reported in *Technika*. One of the line conductors of a normal three-phase overhead system, with insulated neutral, was open-circuited and earthed at the beginning and at the end of the transmission line, power being supplied to a whole district through two overhead conductors and the earth as the third conductor. The transmitted power, chiefly lighting load, varied from 800 to 1,200 kVA. The 35-kV line is about fifteen miles long and consists of three copper conductors, arranged in equilateral triangle, of graduated cross section, varying from 25 to 50 sq. mm., carried on pin type insulators mounted on wooden poles. The experiment had for its purpose ascertaining the possibility of the normal operation of a three-phase transmission line having earth as one of the phase conductors.

The experiment lasted forty-five hours altogether, and during this time nothing abnormal was observed in either the transmission or consumers' apparatus. The tests showed that normal working of a three-phase line consisting of two copper conductors with earth as the third conductor is a practical possibility, and that the electrostatic influence on the neighbouring communication lines 330 ft. distant and under certain conditions even nearer, does not present any danger. These tests have also proved the earth, which in this case was composed chiefly of clay and peat, to be an excellent conductor; its conductivity was 2.16 by 10^{-4}; resistance 0.058 ohms per km., reactance 0.30 ohms per km.; and impedance 0.313 ohms per km. A six-element oscillograph was connected at the feeding end of the transmission line. At no-load, when earth was connected instead of the overhead conductor, the capacity current increased from 0.50 to 9 A; the phase angle between current and voltage was 90 deg., and the vector diagram of the voltage was practically symmetrical. At a load of about 1,000 kVA the current and pressure curves were regular sinusoides of a symmetric three-phase system; the small motor load altered the power factor very little.



Connections of the system

Further experiments are projected on other lines carrying an industrial load.

Cellulose Finishing. By W. A. Wood, A.M.I.E.E.

Its applications in the electrical manufacturing industry

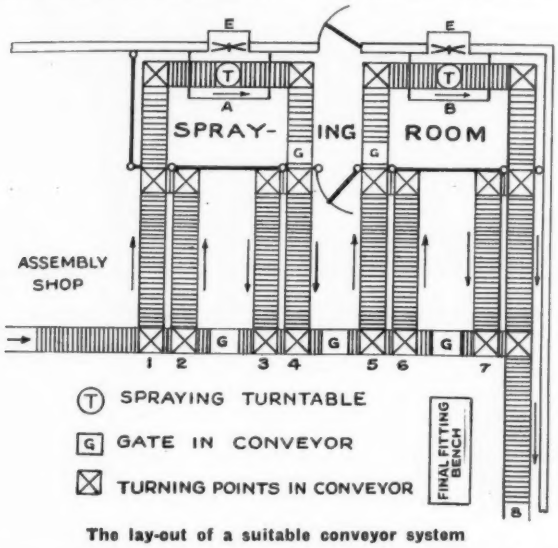
PERHAPS the chief advantage of cellulose spraying over other methods of finishing is that a highly glossy finish equal to that of the best stove enamelling can be obtained without the use of heat. Apparatus containing insulation and other materials which might be affected by heat can be completely assembled and tested before the finishing process is put in hand, thus avoiding possible damage to the enamelled surfaces in the assembly shop.

Before spraying with cellulose, moving parts such as armatures, rotors, shafts and pivots should be protected by paper coverings; oil holes should be plugged and plain nuts and screws fitted where plated ones are finally required. After making sure that the surfaces to be coated are dry and free from oil or grease, two coats of priming spray are given, followed by four coats of filling. Each coat when dry receives a rub down with fine carborundum paper dipped in water. The article then receives two coats of the desired colour with intermediate rub downs. Lining and transfers, if any, are added and two coats of transparent finishing spray complete the job, unless an extra high finish is wanted by wax polishing.

All these processes can follow one another rapidly, since the coats dry off sufficiently to be rubbed down after a period of 20 minutes. Since a small motor, say of 1 h.p., can be given one coat of spray within a minute or so, one man spraying can keep several lads busy rubbing down.

A Handling System

The problem of repeated handling of large quantities of articles is one of greatest importance. The illustration shows a successful scheme of conveyors to keep two men spraying and a dozen lads rubbing down. The articles arriving from



The lay-out of a suitable conveyor system

the assembly shop on the left are pushed along conveyor No. 1 into the spraying room, and thence along to spraying chamber A. After receiving its first coat the article is pushed out along conveyor 4 and up conveyor 2 where it is rubbed down. Other articles following the same route rapidly fill conveyors 2 and 3. Congestion is then relieved by switching the articles coming out of A along conveyor 4 up conveyor 6 for rubbing down, and up conveyor 5 into chamber B. Conveyor 7 can now be used for rubbing subsequent coats. When the final coats are applied the article is moved out along 8 to the final fitting bench. The paper guards are removed and plated nuts, screws, lubricators and name plates fitted. A final test is made and the article is ready for packing.

The spraying room must be built of fire-proof materials; steel framework well glazed and roofed in is the best. A fan, E, must be fitted to each spraying chamber to exhaust into the open air.

The turntables, T, enable the article to be turned to face the spray from all sides. The room should be completely enclosed, sliding doors fitted at all conveyor entries and extra heating available during the winter months. Emergency doors must be provided to give access to the outside of the building and stocks of paints must not be stored in the spraying room. The switchboard for controlling heating, lighting, and fans must be outside.

The conveyors consist of a series of steel tubular rollers mounted on ball races supported on angle iron frames and erected usually about 2 ft. to 2 ft. 6 in. above the floor. The articles to be sprayed are placed on squares of three-ply, which permit easy running and protect the turntables from becoming filled with paint. The initial outlay to erect a proper spraying plant with conveyors is quite considerable, but where large quantities of small articles require high finish the cost of installation is very soon compensated for by cheap and rapid production. The gates, G, shown in the diagram, are necessary if the conveyors are too high or too wide to step over. The turning points are conveniently made with rows of inverted castors screwed to square plates and mounted level with the rollers.

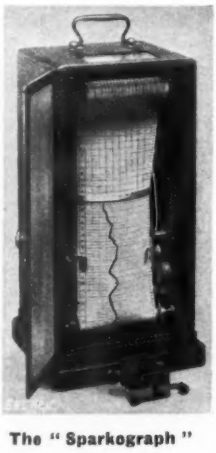
[*Elliott and Fry.*

Mr. W. A. Wood is connected with Messrs. Muller & Co. (England), Ltd., manufacturers of repetition turned parts

A little extra attention is required in the design of articles to be sprayed with cellulose, for whereas a pocket can be satisfactorily coated with paint applied with a brush or by dipping, some difficulty is experienced in avoiding a rough surface when it is sprayed. Small recesses, pockets and sharp edges must be avoided as these do not spray well. Again, if the article is completely or partly assembled before spraying special thought must be given to joints such as those between a motor frame and its end plates, gear box halves and inspection covers. Flush joints which may require breaking at some future date should be avoided as the thick skin of cellulose may break in an irregular line and when reassembled present a jagged appearance. To avoid this all joints should be provided with a raised bead so that the skin may break along the side of the bead; the latter will catch the eye and somewhat conceal the defect.

A Sparking Recorder

THE "Sparkograph," an instrument which has recently been introduced in Paris, makes a record by means of sparks between the point of the needle of a galvanometer and a fixed plate. The spark perforates specially prepared paper and makes a black mark. The registration is thus made without friction between the needle of the galvanometer and the paper, and consequently it is possible to employ an extremely sensitive galvanometer without recourse to photographic devices, the registrations of which do not become visible simultaneously with their production.



The "Sparkograph"

The interchangeable galvanometers and clockwork movements may be made to cover a large range of measurements. The instrument is enclosed in a metal case, and can be used as an ordinary indicator when separated from the register. It can also incorporate a resistance coil or exterior shunts. The rectilinear co-ordinates employed help in the interpretation of the registration, and the unrolling of the paper is continuous. The horizontal co-ordinates of the unrolling paper form a circular arc, at the centre of which is the axis of rotation of the needle.

The high-frequency generator is of the interrupting type, and is attached to the frame of the register. It works off either d.c. or a.c. The high-frequency current is conducted *via* a spark gap to the extreme point of the galvanometer needle, which is isolated from the winding of the galvanometer in order that the circuit in which the apparatus is inserted shall have no connection with the high-frequency circuit. An anti-static filter in the base of the instrument prevents disturbances from the h.f. current.

Tangent galvanometers are made in three types: (A) 100 microamp., resistance 1,500 ohms; (B) 2 milliamp., resistance 75 ohms; (C) 20 milliamp., resistance 1 ohm. The length of the scale is 115 mm. There are three types of clockwork movement, each with three 3-speed gears giving the following movements of paper per hour. (L) 10 mm., 30 mm., and 60 mm.; (M) 60 cm., 300 cm., and 600 cm.; (R) 0.6 m., 1.8 m., and 3.6 m. Other speeds can be furnished varying from 30 minutes to 5 seconds. The instrument weighs 33 lb.

Advances in Electrical Instruments. By A. C. Jolley, F.Inst.P.

Apparatus seen at the Physical Society's Exhibition

FOR twenty-three years the Physical (& Optical) Society has held its exhibitions of scientific instruments and apparatus, and out of the early, and relatively small, beginning the present very excellent display has grown. The exhibition has become one of the most important events of the year in the instrument-making industry and, moreover, it has played no small part in the splendid progress which has been made by the instrument makers of this country during those twenty-three years, and now acts as a definite stimulus and fixes a time in which to complete something new to place before the scientific world.

It is also very gratifying to see how freely and proudly instrument makers now display the internal construction of their products, as compared with the early exhibitions which, one can remember, often contained a somewhat monotonous display of lacquered brass and polished ebonite and boxes which might, or might not, contain the vital essentials of the instrument.

This year's show was characterised by its large number of demonstrations, and the prospective purchaser has now very little difficulty in forming a quite definite opinion of what is best suited as an addition to his experimental equipment. Keen competition among manufacturers to excel in internal as well as external perfection has raised the British product to a standard which is second to none.

High-grade Indicating Instruments

As in former years, there was an extensive display of indicating instruments, all of very high quality, and it was noticeable what an important part the miniature instrument plays in testing equipments. I do not think, however, that we should forget that this type of instrument first came to us from the Weston Instrument Co., which surprised instrument makers with the beautiful work which was put into so small an instrument, and this type can only survive so long as the excellence of that early work is reached or surpassed by all who make them now.

It is now possible to carry an equipment for measuring amperes, volts, and watts over an enormous range in a small attaché case. The latest addition to this collection of pigmies was shown at this year's exhibition in the form of a miniature insulation testing set, complete with its 500-V generator, small enough to slip into the pocket, and weighing from 3 to 4 lb.

One notices a general tendency towards a simpler type of finish in nearly all instruments. The day of the lacquered brass case has gone and now the more subdued black with nickel relief is giving place to the plain matt black finish. In fact, one may say that in all classes of instrument work the general tendency is towards the abandonment of useless display and the adoption of a simple but business-like appearance.

Dry rectifier operated instruments are in considerable prominence, and the Westinghouse Brake & Saxby Signal Co. is experimenting in the direction of reducing the dimensions, and therefore the capacitance, of the rectifier for use in instruments so that they may be used on high-frequency circuits with confidence.

An outstanding advance in illuminated dial indication was shown by the Cambridge Instrument Co. In this instrument the scale itself moves. Now, in the ordinary way, a moving scale to carry reasonable divisions would have to be mounted at such a radius that the mass and inertia added to the movement would be prohibitive. But in this new system the scale is quite small and light and its magnified image is projected on to a translucent front window, and the effect is to give a bold and excellently defined scale reading against a fixed pointer in the centre of the window. Since the image and the pointer are practically coincident, there is no parallax and, moreover, the scheme lends itself to the use of warning colours indicating too high or too low a reading.

The Employment of the Photo-electric Cell

The photo-electric cell has become an important adjunct to a wide range of experimental work, and the possibilities of this device have not yet been fully developed; this is particularly the case in the latest member of the group, the rectifier type, in which a layer of copper oxide or selenium is enclosed between a metal back plate and a metallic surface coating thin enough to be transparent to light and yet sufficient to make the surface laterally conducting. At the last exhibition this was shown arranged differentially as a galvanised relay.

This year the Weston Instrument Co. showed this type of cell arranged as a relay, as a colourmeter for matching colours in terms of three colour filters, or as a directly illumination measurer. In these last two instances the cell is directly connected to a microammeter which can be scaled in appropriate units to give direct indication. These "photronic" cells, independently mounted, are now being supplied by the Weston Instrument Co. Their sensitivity-wavelength curve when compared with the normal eye is higher both at the violet and red ends of the spectrum and the maximum is displaced slightly towards the red, but by the employment of a suitable filter this can be corrected so that the curve is practically identical with that of the normal eye. The Westinghouse copper-oxide cell has its maximum sensitivity in the infra-red, but the company announces that another type will shortly be produced having its maximum sensitivity in the region of the green of the spectrum.

High-frequency Measurements

Apparatus for measurements at audio and higher frequencies was well represented this year and several excellent oscillators for wide ranges of frequency and fair outputs were shown. The use of alternating current at audio frequency is so convenient that a large number of bridge arrangements, each specially useful for some specific purpose, have been developed, and very frequently it is not easily possible to reproduce the necessary conditions in the laboratory from assembled apparatus without introducing troublesome corrections. To meet this difficulty a very neatly arranged universal bridge was put forward by Claude Lyons, Ltd., the various bridge meshes being obtained by the use of special plug fittings which can be inserted into plug receptacles on the bridge top. A unique feature is the provision of an instruction manual on a.c. bridge work; this latter feature is by no means to be despised, for in my experience apparatus is frequently sent out entirely innocent of any instructions as to its use, and, although one may be familiar with the general principles, the actual arrangement may not be perfectly clear from the exterior layout.

Some Municipal Electrical Engineers

From left to right: Mr. A. H. Shaw, Ilford (*Elliott & Fry*); Mr. W. R. Elliott, East Ham (*Elliott & Fry*); Mr. J. Wetherell, Leyton (*Elliott & Fry*); and Mr. N. Staniland, Hornsey (*Valentine Bibbs*).

Certainly more is wanted to indicate the interior system of connections, what voltage may be applied and, in many cases, what is the current-carrying capacity of the apparatus. This information should be available when the apparatus is in its normal position, not, as we have sometimes found it, only to be obtained by turning the whole apparatus upside down. The employment of the system of clearly marking on all apparatus the voltage and current rating has proved a very effective safeguard to apparatus which previously gave considerable trouble.

The thermionic valve is now well established in electrical measurements and valve voltmeters are a recognised part of the equipment of most laboratories. Instruments, mains-operated and covering a range of from 1 to 150 V for all frequencies up to about 2×10^6 cycles, were shown by the General Electric Co., Ltd., and Salford Electrical Instruments, Ltd., a novel feature of the instrument being the provision of a series of transparent celluloid scales which can be dropped into the window space, making the instrument direct reading on each range.

Cathode-ray Oscillographs

A new-comer to the valve-operated instruments is a much-needed audio- and radio-frequency wattmeter designed by Dr. Mallett, which Messrs. H. Tinsley & Co. are putting on the market. The electromagnetic oscillograph has now reached a stage when it becomes difficult to effect any further improvement, so that it was not strongly represented this year. On the other hand, the cathode-ray oscillograph is becoming increasingly important to both scientific and industrial research, so that considerable attention is being devoted to the development of equipments which make it readily applicable to the study of rapidly periodic, transient, and high frequency phenomena. Some of these applications were demonstrated at the exhibition, and it is noticeable how perfect the arrangements of the sweep circuit can be made and the excellence of the definition which can be obtained. A specially neat arrangement suitable for a frequency range of .0 to 50,000 cycles was demonstrated by Standard Telephones & Cables, Ltd.

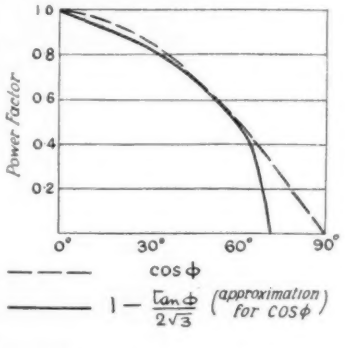
The harmonic analysis of a wave form is often of as great importance as the delineation of the wave form itself, and mechanical devices of great beauty and high accuracy have been devised for this purpose, but these are necessarily expensive luxuries not often found except in lavishly equipped laboratories. Electrical analysis is, however, not difficult, and the apparatus devised by Prof. Miles Walker for this purpose is now quite well known; but, unfortunately, this gives only the magnitude of the harmonic and not its phase.

Quite recently Mr. Gall, of Messrs. H. Tinsley & Co., devised a very ingenious extension of the old Joubert contact maker, which enables the harmonic component to be measured on a d.c. potentiometer for any phase position. Instead of a single contact per cycle, three, five, seven, nine, &c., symmetrical contacts per fundamental cycle are successively used, and the residual e.m.f. measured by the potentiometer gives the instantaneous value of the third, fifth, seventh, ninth, &c. harmonic in each case for that phase position; and, since the phase position can be changed by altering the angular position of the contact maker, each harmonic wave can be plotted in its proper phase position. The method can be carried as far as the fifteenth harmonic; beyond this difficulties arise on account of the number of contacts.

Three-phase Power Factor.

By G. W. Stubbings, B.Sc., A.M.I.E.E.

WHEN three-phase power is measured by the two wattmeter method, the ratio of the readings of the wattmeters is a function of the phase angle of the circuit, if both current and voltage are balanced. As absolute balance of a three-phase circuit is only a theoretical abstraction, any calculation of power factor based on wattmeter readings is subject to errors which, with commercial nominally balanced circuits, are quite considerable. The method is thus unfitted for anything else than the determination of rough approximations. Provided, however, that the limitations are borne in mind, the two-wattmeter method is in certain circumstances very convenient, since it can be carried out without any special instruments. A three-phase watt-hour meter can be used for the evaluation of the two separate wattmeter readings by observing the speed of the rotor with each of the voltage windings disconnected in turn.



Three-phase power factor is essentially a ratio. The separate wattmeter readings give the sum of fractions of the circuit watts and reactive volt amperes, and the ratio of the wattmeter readings will be thus primarily a function of the tangent of the phase angle of the circuit. If the ratio of the difference to the sum of the wattmeter readings is taken, this ratio is directly proportional to the tangent of the phase angle. Ratios of the wattmeter readings lead to a function of the tangent, and this is a disadvantage of the wattmeter method of determining power factor; although the conversion of the tangent to the cosine is simple, the calculation is troublesome. Moreover, the wattmeter method will be most used for field tests.

A number of approximations to the theoretical formula for turning wattmeter ratios into power factor have been devised which give good accuracy over a restricted range, but most of these approximations cannot be remembered readily. What is perhaps the simplest of all approximations is comprised in the following rule: power factor equals the ratio of the lagging phase wattmeter reading to the total watts plus one half. The quantity expressed by this formula is actually equal to $1-\frac{\tan\phi}{2\sqrt{3}}$, since $\tan\phi=\sqrt{3}\frac{W_1-W_2}{W}$. The accuracy of the approximation is indicated by the corresponding values which follow:—

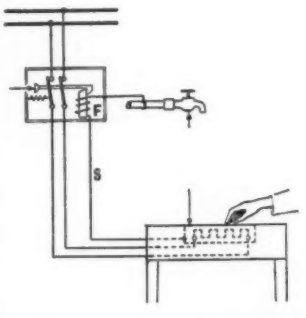
Power Factor = 0.5 + (W_2/W) approx.

Actual	Approximation	Actual	Approximation
0.9	0.86	0.6	0.61
0.8	0.78	0.5	0.5
0.7	0.70	1.0	1.0

The formula gives accurate results at unity and 0.5 power factors. A consideration of the derived functions of the cosine and tangent shows that it is inaccurate for small phase angles. Between power factors of 0.9 and 0.5 the approximation is sufficiently close for the formula to be quite serviceable. Below power factors of 0.5 the formula is useless. If this method of calculating power factor is based upon the speed of the rotor of a watthour meter, it may be more convenient to determine the times taken for a definite number of revolutions of the disc, first with both elements connected, and secondly with the voltage circuit of the leading-phase element disconnected. No mistake can be made as to the identity of the voltage circuit to be disconnected, as the ratio of the times taken for the specified number of revolutions must be less than one half, unless the registration of the lagging-phase element is reversed, in which case the approximate method of power factor calculation is unreliable. If the basis for the calculation be the times for a specified number of revolutions, instead of revolutions in a specified time, the ratio to be added to 0.5 to obtain the power factor will be that of the time with both elements connected to that with the leading-phase voltage circuit disconnected.

An Automatic Switch for Domestic Circuits

The accompanying illustration, from *Elektrotechnische Zeitschrift*, shows the connections and principle of operation of a new isolating switch developed by the Siemens Schuckertwerke for use in lighting and heating circuits carrying up to 15 A. and for motors up to ½ kW at pressures not exceeding 380 V a.c. The switch is made in two- and four-pole patterns, with a base of fireproof ceramic material and a cover of moulded insulation. Press-button operation is provided, two brown buttons respectively closing and opening the switch. On pressing a third testing button (coloured red) the fault-current coil F is connected to each of the supply wires in turn through a high ohmic resistance. The protective action can thus be tested at any time. The trip coil is connected in the earthing lead as shown, hence the switch is opened directly the insulation of the branch circuit becomes defective. The switch cannot be closed after the renewable contact pieces have worn to a predetermined extent, and overheating due to bad contact is prevented.

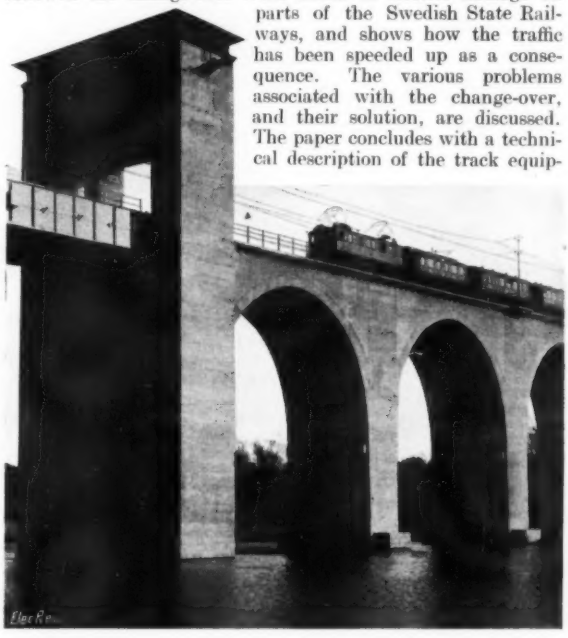


MEETINGS AND DISCUSSIONS

Current Topics and Opinions Expressed at the Institutions

Sweden's Experience of Main-line Electrification

THE paper on "The Economics of the Swedish State Railway Electrification" which Mr. I. Ofverholm read on January 5th in London at the INSTITUTION OF ELECTRICAL ENGINEERS gives details of the financial results that have followed the change-over from steam to electric haulage on parts of the Swedish State Railways, and shows how the traffic has been speeded up as a consequence. The various problems associated with the change-over, and their solution, are discussed. The paper concludes with a technical description of the track equipment and electric locomotives. A cinema film illustrated the paper.



[*Swedish Travel Bureau*

The electric railway over the Aersta Bridge

The primary object of electrifying the railways was to make them independent of foreign fuel. The scheme has proved to be not only an excellent method of utilising the abundant supply of water power, but also a very good means for improving and increasing the railway service and consequently for competing favourably with other forms of transport. At the beginning of 1932 a total of 565 route-miles was electrically operated, and a further 535 route-miles is now being electrified. At the beginning of 1934, therefore, 1,100 route-miles will be in electrical operation, corresponding to 26.3 per cent. of the whole anticipated length of the system. According to the present schedule a further 580 route-miles will be electrified in the near future, and the electrification will then comprise 1,680 route-miles, corresponding to about 40 per cent. of the whole proposed length of the State system.

Improved Mineral Transport

At present two sections are in electrical operation; they are the ore railway in the north (280 route-miles) and the Stockholm-Göteborg line (285 route-miles). The electrification has entirely changed the conditions on the ore railway. The carrying capacity of the ore-train units has been increased by about 50 per cent. and the average speed of these trains has been doubled. The carrying capacity of this railway has therefore been trebled, the building of a new double track has been avoided, and great savings in staff wages and maintenance costs have been effected.

The electrification of the State Railways, however, has not been quite so advantageous as existing station arrangements and other circumstances have not allowed longer train units to be employed.

The electrification has proved to be very satisfactory, however, from the beginning, both as regards transmission and also the design of the locomotives. The reliability of operation is considerably better than for the superseded steam system, and that the electrification has the entire approval of the public is evident from the fact that a great increase of traffic immediately resulted.

Supply Arrangements

The State Railways are ordinary consumers of three-phase current from the general transmission system, and are therefore able to increase or decrease their consumption of energy according to the traffic conditions without having to take into consideration to such an extent the capacity of the generating plant, and the size of transmission lines, as would have been necessary if the single-phase power had been separately generated. For economical conversion it is, however, necessary for the distance between convertor stations—the feeding points for the railway catenary system—to be at least sixty miles. For a consumption amounting to about 70 million kWh per year the following tariff was agreed upon:—

(1) An annual charge, corresponding to the cost for transmission, of £40,600, and, in addition; (2) an annual charge for contracted or basic load of £5 7s. per kW (15 minutes' demand); and (3) an annual charge for peak load above the contracted basic load of £1 18s. 6d. per kW, measured over 15 minutes by a maximum-demand meter, and, in addition, a charge for peak energy of 0.33d. per kWh. The 1,660-h.p. locomotives are able to haul a train weight, exclusive of locomotive, of 550 tons at a maximum speed of 60 m.p.h., and with freight train gear a train weight, also exclusive of locomotive, of 900 tons at a maximum speed of 45 m.p.h. For switching operations another type was built, and important savings have been experienced due to the standardisation of the locomotives to only two types. Whereas the total maintenance cost per locomotive-mile for steam was 4.65d., the total for the electric locomotives has been 2.3d.

The conversion schemes now being undertaken, and those to follow, are estimated to cost more than if steam operation were to be continued, but a net profit is anticipated without taking into consideration the increase in receipts that may result from the change-over or the social advantages gained.

[*Swedish Travel Bureau*

The Sodertalje Bridge

Shortcomings of Mining Electrical Plant and their Remedies

THE paper which Mr. A. R. Cooper has read at several provincial centres of the INSTITUTION OF ELECTRICAL ENGINEERS discusses the application of electricity to machinery used in coal mining. Common sources of trouble are described, and possible remedies suggested, including the design of such gear specifically for its purpose, instead of merely installing industrial types placed in cast-iron jackets or boiler-plate tanks.

All switchgear should be capable of connection to cables by plug-in boxes, so that internal connections need not be disturbed underground and cables could be isolated by simply withdrawing plugs. Oil-immersed switch tanks should be of the circular screw-off or flame-proof bayonet-joint types; the unscrewing of numerous nuts before the tank can be lowered leaves much to be desired. There should be some external means of putting low-voltage trips out of action. If in-bye (mothergate) switchgear were plugged into a common busbar chamber, instead of being connected in line, individual switches could be withdrawn without interfering with the supply to the others.

A serious disadvantage of most mothergate switchgear is that little or no adjustment of the time-lag of the overload trips is possible. Short time-lags are very undesirable; thermal operation of the trip may solve this problem. Discrimination should be exercised in fitting earth-leakage equipment, or a very slight earth fault on one machine may interrupt supply to a very large district.

Onerous Conditions

Control gear for coalface machinery often works under most abnormal conditions. Many manufacturers do not seem to realise how much the standard of safety is increased by designing insulation with long and irregular creepage paths, while provision for preventing the ingress of moisture along switch-operating spindles, &c., is often conspicuous by its absence. The slightest shock quickly develops distrust among workmen, and an innovation that would stimulate confidence would be the use of insulated or non-metal handles. The ideal switch for face conveyors and similar machinery would appear to be one of the straight-on contactor type operated by low-voltage start-stop push-buttons.

Mr. A. R. Cooper, A.M.I.E.E.

Trouble due to floor movement would be very greatly reduced if underground haulage gear were designed as self-contained units independent of any support from the side walls of the engine house; erection and dismantling would also be facilitated thereby, and the cost of the engine house reduced. Another departure from standard practice which is strongly recommended is that for all but the smallest haulages the first reduction should be by belt or ropes, not by spur and pinion. This may be regarded as a retrograde step, but the author's experience has convinced him that the change would be justified. Haulage requires far more delicacy of control than can be obtained with a squirrel-cage motor and friction clutch, and it is suggested that a better combination would be a slip-ring motor with rotor control, preferably of the liquid type, float-control interlocked with the main switch.

The most satisfactory terminal box for underground motors is the plug-in type. Ball and roller bearings appear to have come to stay; but though they possess high efficiency they are not an unmixed blessing. Ball races and motor couplings which are a press fit on their shafts are very bad for the maintenance man.

Will Flameproof Enclosures Become Obsolete?

The Coal Mines Act regulation relative to flame-proof enclosures could with advantage be redrafted to avoid ambiguity of interpretation, but the author thinks that the attitude of those responsible for the safe working of underground electrical plant will in the comparatively near future undergo a radical change. If, for instance, matters could be so arranged that the formation of an explosive atmosphere would automatically cut off the supply of electricity, the necessity for providing flame-proof enclosures would not arise.

Mobile in-bye sub-stations have advantages; transformers and switchgear should not exceed the dimensions of ordinary pit tubs, so that they could be mounted on undercarriages and moved about like ordinary pit traffic. The most dangerous cable in a coal mine is the trailing cable. Its dangers could be eliminated by surrounding all the live cores with an earthed metallic screen and providing leakage protection.

The necessity for obtaining better-class labour for underground electrical work is emphasised. The author recommends the compulsory certification of underground electricians, and stresses the importance of keeping systematic maintenance records, typical charts being reproduced in the paper.

Ultra-short-wave Radio Research

TWO papers (both communications from the G.E.C. Research Laboratories, Wembley) were read in London on January 4th before the Wireless Section of the INSTITUTION OF ELECTRICAL ENGINEERS by Mr. E. C. S. Megaw. One paper is a critical summary of the existing knowledge of electronic oscillations and of their production in triode, diode, and magnetron circuits. The application of these oscillations to ultra-short-wave communication is outlined, and apparatus used in a recent demonstration is briefly described.

Electronic oscillations are produced in a circuit connected to a thermionic system by virtue of electron inertia in the system. They are to be distinguished from reaction oscillations produced by triodes by means of feed-back from anode to grid circuits, and from dynatron oscillations produced by thermionic devices operated so that the rate of change of current with voltage is negative over a certain range of the static characteristic. At frequencies sufficiently high to make the inertia of electrons appreciable in determining their motion, the mechanism of maintenance of the last two types of oscillation begins to break down. At higher frequencies electronic oscillations alone are possible.

Barkhausen and Kurz used their oscillators for telegraph and telephone communication over distances of about ½ km. without any amplification. Uda has obtained 10-km. telephony and 30-km. telegraphy ranges with about 0.1 W output from a two-valve transmitter, using highly directional aerials at 50 cm. wavelength. Beauvais has obtained a maximum range of 38 km. (telegraphy) from the top of the Eiffel Tower, using Pierret oscillators for transmitter and receiver, and paraboloidal reflectors. The output was probably of the order of 0.1 W and the wavelength 17 cm. In the Dover-Calais demonstration of the I.T. & T. Laboratories on 18 cm. (March 31st, 1931) duplex telephony was achieved over a distance of about 34 km. with about 0.5 W output and special reflectors.

These results give a general idea of the possible communication ranges. The discussion of directional aerials, which can be easily constructed to give very high gain at these wavelengths, and of the phenomena of ultra-short-wave propagation, is outside the scope of the paper, but it is concluded that electronic oscillators in conjunction with suitable aerial systems are capable of providing communication up to the limit of range set by conditions intervening between transmitter and receiver.

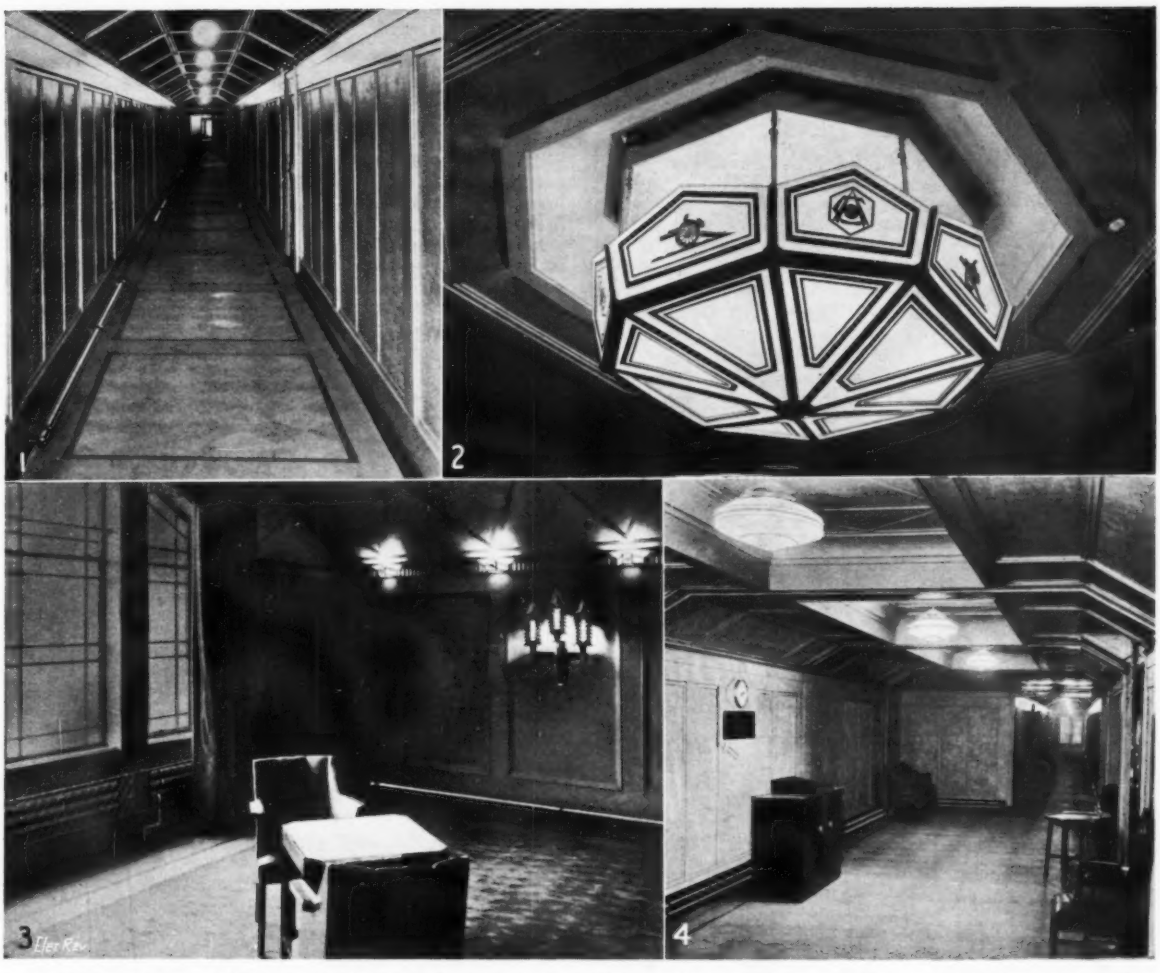
Magnetron Short-wave Valves

The other paper discusses possible methods of utilising magnetrons to generate short-wave oscillations and the more important results of previous workers are described. The theoretical basis of "electronic" and "dynatron" oscillations is discussed, with particular reference to those features which can be investigated experimentally. The wavelength of the electronic oscillations is determined mainly, if not entirely, by the electron time of transit, the general expression for which is given and hence expressions for wavelength in terms of magnetic field strength are obtained for zero and saturated space-charge conditions. The wavelength is about 36 per cent. greater in the latter case; initial electron velocity causes an appreciable reduction in wavelength in normal cases. The effect of magnetic field on space charge leads to a small, possibly negligible, increase in wavelength; the space charge is uniformly distributed when the magnetic field strength exceeds the critical value. Hull's deduction that the electrons travel in circular orbits round the cathode is disputed.

An attempt to provide a simplified theoretical explanation of the "dynatron" characteristics of a "split anode" magnetron leads to a false result from which it is concluded that no theory will provide an explanation which does not take into account the non-uniformity of the electric fields in the two halves of the valve. The general shape of the static characteristics is indicated by means of Habann's theory, which is, however, not capable of giving proof of the existence of negative resistance in the case of a symmetrical oscillatory circuit. A qualitative explanation of the occurrence of negative resistance, *i.e.*, of the greater fraction of the anode current reaching the lower-potential anode segment, is given.

Mr. E. C. S. Megaw

The experimental results confirm that the strength of the electronic oscillations is greatest at the "critical" relation between anode voltage and magnetic field strength, and that the wavelength of the optimum oscillation is inversely proportional to the magnetic field strength. The actual wavelength and the amount of change due to space charge both



Interesting features of the new stand of the Arsenal Football Club at Highbury (see page 30): (1) A corridor showing the tubular heaters; (2) the centre lighting fitting in the smoking-room; (3) the directors' reception room with tubular heaters and "Sunray" lighting fittings; and (4) the lounge

agree with the theoretical values within experimental accuracy. It is concluded that the effect of magnetic field on space-charge distribution is not great enough to affect the wavelength appreciably.

The existence of an optimum field angle differing from zero is due to the resultant spiral motion of the electrons balancing out the effect of cathode potential-drop for electrons arriving at part of the anode surface in such a way as to increase the number of oscillating electrons. By making use of an internal resonance effect and suitably adjusting the field angle, an output of the order of 1.5 W was obtained at a wavelength of about 24 cm.

The wavelength of the electronic oscillations can be expressed in the same form as the Barkhausen-Kurz equation for the triode case, and the existence of an optimum value of anode current (approximately 1-10th of the space-charge saturation value) leads, as in the triode case, to the result that the minimum wavelength obtainable without overloading the valve depends on the anode diameter and decreases with it. For an anode diameter of 3 mm., the shortest wavelength at which optimum oscillating conditions can be maintained is of the order of 20 cm. The corresponding figure for the triode case (grid diameter 3 mm.) is about 50 cm. The shortest wavelength actually observed was 18 cm.

Dynatron Oscillations

It is possible to obtain dynatron oscillations in a split-anode magnetron by tilting the magnetic field; these are distinct from both the electronic and simple dynatron oscillations, and can be produced down to about 35 cm. wavelength, but at this wavelength the effect of electron inertia is important. In the investigation of the simple dynatron oscillations static characteristics showing the negative resistance effect are obtained. From these curves the operating characteristics of the valve are calculated and checked by comparison with a set of measured values (for a relatively low frequency) and good agreement is obtained. The energy of the dynatron oscillation starts to fall off rapidly at a wavelength about four times the electronic oscillation wavelength corresponding to the anode voltage used. This leads to a formula for the wavelength limit for dynatron oscillations.

The relation between oscillation amplitude and anode voltage is discussed, with particular reference to modulation. During oscillation the anode current may exceed the original total emission, probably due to bombardment of the filament by electrons which return to it with considerable velocity. By taking steps to reduce this effect it has been possible to obtain an output of 60 W from a relatively small valve at about 2 m. wavelength. The shortest wavelength obtained by dynatron oscillations was about 30 cm., the power obtainable being about 0.1 W. It is concluded that for wavelengths below about 50 cm. electronic oscillations give the greater output.

* * *

Metal Furnaces.—A lecture was delivered recently to the PAISLEY ASSOCIATION OF ELECTRICAL ENGINEERS by Mr. A. G. Robiette on electric furnaces. It was illustrated with lantern slides and dealt with many industries in which furnaces are required for metallurgical purposes, and showed that the electric furnace is more efficient, costs less to run, and produces a better finished article in nearly every industry in which this type of furnace is used.

Electricity in Gas and Waterworks

THE quantity of gas produced in 1930 is given in the *Board of Trade Journal* as 318 million cub. ft., an increase of 16.3 per cent. over 1924. The amount of electricity used in gas works was 64 million kWh, of which 16 million kWh was purchased; information for 1924 is incomplete, but undertakings owning 73.3 per cent. of the works generator capacity and 94.5 per cent. of the motor capacity driven by purchased electricity used 36.5 million kWh. The capacity of motors in 1930 supplied from works generators was 63,000 h.p., and of motors supplied from outside sources 27 691 h.p. Deducting the capacity of works generators (36,000 kW) from the total figure of prime movers in 1930 leaves 163,000 h.p. for other power.

Electricity used in waterworks in 1930 amounted to 55 million kWh, of which 49.5 million was purchased. In 1924 undertakings owning 73.6 per cent. of the works generator capacity and 89.6 per cent. of the motor capacity driven by purchased electricity used 21 million kWh. Deducting the capacity of works generators (6,400 kW) from the total figure for prime movers in 1930 leaves 175,000 h.p. for other kinds of motive power, which should be regarded as the lawful prey of the electrical industry.

Correspondence

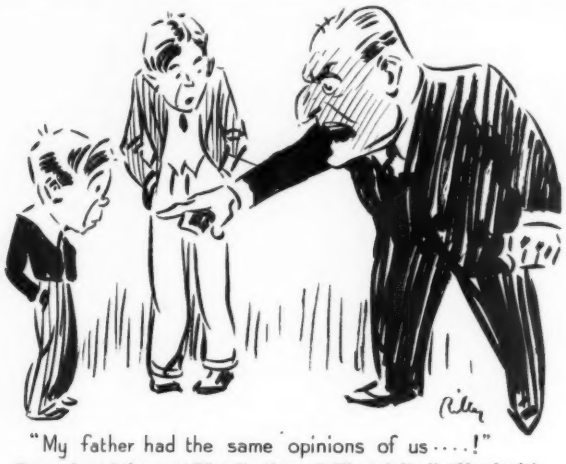
Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

Inadequate Mains: Indifferent Employés

"M.I.E.E." is quite correct in advising that a youth should not enter the electricity supply industry straight from boarding school, but he is in error when he asserts that I stated in my letter that I perpetrated that rash act. The first three and a half of my ten years in the electrical industry were spent at that best of all practical universities—the maintenance bench of a large, self-contained industrial concern which offered me a good training on the understanding that I left at the age of twenty-one.

During four winters of this time I attended evening classes at a celebrated technical college three days per week, upon each of which I was out of my home for sixteen hours at a stretch. I am not a brilliant scholar, and after my week's homework was finished I had not even enough spare time to feel spoiled or pampered.

I then entered upon my present noble calling, fully expecting to find the standard of engineering intelligence to be on a par with the polished eye-bolts and check flooring. However, such was not the case, and a short time ago I was not very



"My father had the same opinions of us....!"

Reproduced from "Distribution of Electricity" (Henley's) by kind permission of the Editor

surprised to be told by the only senior man who congratulated me on having passed the City and Guilds of London final and the I.E.E. examinations that my best plan would be to "get out" as "men with brains are not wanted here."

During my association with the supply industry two of the senior men earning the not inconsiderable total of £2,300 per year have been "retired" for what were officially described as "irregularities" and which, by the way, might more aptly have been described as "regularities." Such are the men to whom I am urged to be loyal.

In conclusion, it would give me much pleasure to commence 1933 in a better spirit than that which "M.I.E.E." finished off 1932 by wishing him a much happier New Year than I fear I am likely to enjoy. AN INDIFFERENT EMPLOYÉ.

January 1st.

"Indifferent Employé" states that he has had "brickbats," &c., thrown at him and that he is not wanted in his department because he has come from a school and knows something. Why doesn't he grin and bear it and think himself lucky he has a post and one that carries future promotion? Since leaving school eight years ago (I am now twenty-two) I have made between fifty and a hundred applications in different parts of England for a progressive situation in the electrical industry and am still unsuccessful.

"M.I.E.E." says that a fellow with "guts," brains, and practical training and who is decent and loyal can get on in the electrical industry. Well, for eight years I have been employed in the stranding department of a leading cable firm and for the last four years I have done day-shift one week (fifty-eight hours) and night-shift the following week (fifty-two and a half hours) and I don't think my wage is much different from that which "M.I.E.E." had when he started work, taking everything all round, and there is no promotion either.

I have learnt from books at home and will tackle any electrical installation with any skilled man, so I think that covers two of "M.I.E.E.'s" qualifications (i.e., "'guts' and brains"). As to practical training, I have only had that which I have picked up myself. As to decency and loyalty, I will give anyone a lift over the stile and have never tasted wines or beer in my life nor used any cheek to my foreman. Then how is it that I can't get on?

I say it is this, and one thing "M.I.E.E." ought to have included in his qualifications: you must have someone to push you from behind or else buy your situation, or you get nowhere at the present day. KEEP ON HOPING.

December 30th.

I had a sound general education: three years as a premium pupil coupled with a three-year part-time day and evening course in mechanical and electrical engineering. For five years I have held the position of switchboard attendant in a generating station, having previously been sub-station attendant for four years. I have "swotted" and tried to improve my position without success.

The next rung in my ladder should be charge engineer. To my mind due to the size of the stations no chief engineer is going to take a charge engineer from the control room. The problem thus arises how can a switchboard attendant secure the position of junior charge engineer in a large station? I have not met with any success and as more and more stations close down this will become more and more difficult. Perhaps "M.I.E.E." will be good enough to give us a few hints.

Mr. R. D. Reynolds would be much appreciated by myself and others if he could tell us whether there is any possibility of securing a position as junior in a showroom. I am greatly interested in the consumer's side of the industry and am prepared to move anywhere and at less salary to secure one of these positions. Apparently the fact that I am a switchboard attendant immediately rules me out of consideration. Surely a knowledge of generation should prove of value in this department, but it seems that chief engineers do not agree.

Are we to remain switchboard attendants all over lives and so become "Indifferent Employés"? OPTIMIST.

December 31st.

I can truthfully endorse "An Indifferent Employé's" remarks concerning the incompetence and lack of technical knowledge on the part of those in authority. I read the letter of "M.I.E.E.," however, with disgust—it is the usual tale of those favoured with success. I can assure him that given "'guts,' brains, and proper training," it is only by luck that a young man can get on to-day, unless he has money or "a push" behind him, particularly the latter.

I have had an excellent education and good training, and have a fair supply of the qualities named by "M.I.E.E." Night after night, or rather morning after morning, have I studied from 2.30 a.m. to 6.0 a.m., and then proceeded to do a full day's work in an engineering factory. Unfortunately, I am starting in a less prosperous time than "M.I.E.E." I have worked, at much less than a living wage, in a D.O., where the lack of technical knowledge was very evident in those in authority. Often have I been informed with hidden sarcasm that people with knowledge are not wanted. The majority of firms to-day require one to be a "cog in the machine" and nothing more. STUD. INST. C.E.

December 30th.

Being one of the present day spoiled and pampered youths, who is desirous to throw his weight about when given an opportunity, I cannot let "M.I.E.E.'s" observations pass without comment.

First I may say that considering the low cost of living in 1898, a salary of 15s. per week appears to have been a princely one compared with some of those offered nowadays for the same occupation. What is meant by a training in theory and in the shops, I fail to understand; nevertheless it would hardly have been as elaborate and difficult as the standard demanded these days, a.c. practice being then in its infancy.

When all is considered I doubt whether "M.I.E.E.'s" house is any less a glass one than that of the spoiled and pampered youths, and therefore the throwing of stones is dangerous. May I ask if he sat for an examination to obtain his M.I.E.E. or whether, like many more, he obtained it without any technical qualification whatsoever, save being in the job in the then small electrical engineering profession? The competition for good positions is much more severe than in his day—a fact also to be remembered.

Can loyalty be expected in instances where the ideas of the young engineer are treated with contempt?—or if utilised, no credit given and used to another's advantage under the cloak of

authority; this often happens. No mention of the magic word "influence" is made in his formula for success; I suggest its insertion in the average case. How often do the words "Canvassing will disqualify" appear when vacant positions are advertised (generally in the more responsible and highly paid ones); the very fact of its appearance seems to suggest that it has been tried (or is).

Finally I must say that I have no personal axe to grind, I am very well satisfied with my position and progress, therefore I write without prejudice; I would also have it remembered by our elder brethren, especially "M.I.E.E.," that comparatively young men, before they reached the half-way stage in life, contributed much to the success attained so far in the electrical engineering world; and some of the present day "spoiled and pampered youths" are still doing so.

December 31st. B.Sc., GRAD.I.E.E.

I cannot say that I altogether agree with "Indifferent Employé," though I can appreciate his point of view, but I must object to "M.I.E.E.'s" reference to "the present-day spoiled and pampered youth," of whom I must consider myself a member. In the days of 1898 the sphere covered by electrical knowledge and practice was small and therefore left very little room for criticism, whereas conditions to-day are very much the converse of this. Furthermore, it must be remembered that many men holding executive positions in supply undertakings to-day have "grown" into those positions, and would not stand the same chance to-day as they did in 1898.

Regarding the chances offered to-day in the electricity supply industry, I cannot agree with "M.I.E.E." that a "young man with 'guts,' brains and a proper training" will be able to get on, even if he is a "decent and loyal fellow" and can produce excellent references as to his abilities. With the institution of the British grid, and so many of the smaller supply undertakings being shut down, men of a more mature age are securing jobs which would normally be open to the beforementioned "pampered youth."

I myself have had a theoretical training and served my "time" with a well-known firm of manufacturers, even to securing a minor executive position with them during the latter part of the apprenticeship, but owing to the depression, &c., I had to relinquish that status, and have tried again and again to obtain a suitable situation, even by letter through this very paper, but have had not a single reply. As hard as you try nothing seems to turn up to help, and if you put your thoughts into words you are disloyal and are "groaning about conditions." PAMPERED YOUTH, Grad. I.E.E.

December 31st.

I have returned recently from a six-year sojourn in the United States to live here within one mile of the electric power mains. We have a well for water with a hand pump, which is waiting for an electric motor; oil lamp illumination in the house and dreadful darkness in the grounds where one may stumble about and hurt oneself in the sandpits or near the gloomy stables. So why have a depression in jolly old England? More electric light! Why, my dear sirs, you have so much work to do that I honestly don't know where you should start first. Why have you only *one* electrified main-line railway? In this house here I need at once electric light, power and heat, and plenty of it; an electric oil burner; a pump for the water; a motor floor polisher; a vacuum cleaner; a washing machine; an ironer; a motor for the sewing machine and other appliances.

No matter what the cost is now, lay heavier power lines in West Gloucestershire, Mr. Reynolds. Don't ponder over the priority of hen or egg; there will be ample rewards later. Have rural construction all over the country.

Smile, "Indifferent Employé"! You have a job; tell your friends to use electric oil burners in their houses, controlled by electric cuckoo clocks which will remind you at least twice daily that your job is a good one, and quite good fun. Slide rules are only a means of expanding your service, and brains without character are pretty useless anywhere.

Don't be too unkind to youthful despondency, "M.I.E.E." We don't have so many enthusiastic hot cables or scintillations in these less heroic days. I have been without a job for eighteen months and I have plenty of time for criticism. I have viscera, brains, and a very proper training, but I cannot get a job in the electricity supply industry, though I am a decent fellow and loyal, because worthy people in authority have so little courage and so little proper vision of the future. And *not* because there is nothing to do in the electrical industry in England. "Where there is no vision the people perish." Look forward, not back.

FELIX P. WILLS, B.Sc., Associate A.I.E.E.

Midhurst, Sussex, *December 31st.*

The large illuminated clock in the centre of this picture is described on page 30

The letter from "An Indifferent Employé" published in your issue of December 23rd regarding my article under the above heading seems to me to emphasise the necessity for a campaign to enlighten many of the people employed in our industry. How can maximum progress be obtained when people in our own ranks hold such views?

He refers to profits of 50 per cent. on electrical appliances. Profits on electrical appliances in common use are nothing like this figure, and on many appliances are not nearly so high as the profits on articles sold by drapers, hosiers, and other traders. The case of the table lamp and the additional socket shows the need for adequate wiring at the start, which will not necessitate the calling in later of an electrical contractor to install one additional point.

His friend's £750 house being provided with only two plug points is a disgrace. No doubt a considerable part of the £750 was spent in the provision of unnecessary fireplaces and chimney breasts. The savings by adopting modern methods are generally sufficient to more than pay for an adequate electrical installation. "An Indifferent Employé" is apparently quite prepared to condemn, off-hand, electric heating and water heating as being far too expensive, irrespective of the price charged for electricity and other considerations. I am all against advocating the indiscriminate use of electricity for continuous heating and for water heating when the rate is uneconomic, and in encouraging employés to push the use of electricity whenever the opportunity offers I should warn them against this.

Your correspondent seems to have a general grievance against his undertaking and against certain individuals in particular; he should not, however, lose sight of the fact that the industry is providing his bread and butter. If he requires something more and is really itching for a more responsible job he would be well advised to cultivate a different outlook, when he would perhaps see things in their true perspective, and not be ready to condemn the whole industry.

Gloucester, *December 30th.* R. D. REYNOLDS.

Radiated and Convected Heat

In his letter published in your issue of December 23rd, Mr. McConaghy refers to a school in which the heating apparatus employed dissipates heat energy in the proportion of 68 per cent. radiation and 32 per cent. convection.

It is, of course, impracticable to lay down a hard and fast rule as to what in all cases should be the correct proportion of radiation and convection, but for the building to which Mr. McConaghy refers my view is that he would probably secure better results with apparatus giving about 60 per cent. convection and 40 per cent. radiation. I adopted this proportion for a hall with a volumetric capacity of 27,600 cu. ft. and an average height of 21 ft. The windows have 456 sq. ft. of glass. It is used as a large general office and the electrical loading of the heaters installed is only 11.76 kW. During average winter conditions a time switch automatically operates the heaters at 7 a.m. and the reports are satisfactory.

It is of the utmost importance that heaters should be placed

in positions calculated to give the most effective results, otherwise more thermal units are needed to give the required conditions of comfort, with a consequent increase in the operating costs. The placing of heaters, whether radiators or convectors, immediately below a row of open top windows would be of little use if the windows are to remain permanently open during the winter. The object of heaters in such positions is not only to offset the loss through the glass but also to counteract the downward movement of cool air from the upper part of a lofty interior, and if this is explained to those responsible for operating the heating system they will not be slow to display a sense of proportion with regard to the opening of the upper windows. J. LESSER.

London, E.C.1, *December 28th.*

We have read with interest Mr. McConaghy's letter in your issue of December 23rd, in which he points out the obvious anomaly of controlling radiant electrical heating installations with air thermostats.

It will be of interest to your readers to know that an instrument called a eupatheostat has been designed to control radiant heating installations in a manner not primarily dependent upon air temperature. This instrument has been described in your columns, and it is, we venture to think, a complete answer to the anomaly quite properly pointed out by Mr. McConaghy. BARKER, YOUNG & CO., LTD.

London, S.W.1, *December 29th.*

Ill-advised Criticism

It is surprising that so much criticism of the paper on "Electricity and Other Heating Agents" recently read before the Institution of Electrical Engineers by Mr. A. H. Barker should have come from the protagonists of electricity. That criticisms should have come from hot-water and gas engineers is not surprising. Hot-water heating is shown in an unfavourable light as compared with electrical heating and with *local* gas heating. Local gas heating is shown in a favourable light as regards overall efficiency as compared with any other form of heating. On the other hand, the author is careful to point out that local gas heating is undesirable and unsuitable for the majority of buildings.

According to the author's reasoning, therefore, electric heating of suitable types is the most appropriate for modern buildings upon the grounds of operating efficiency and cost. It must be evident to anybody who has read the paper that the author has been at the greatest pains to treat the matter fairly and to take average results, based upon general experience and upon particular tests which most of us should envy.

Let those sections, therefore, of the electrical industry which might be affected by the wholesale adoption of electric heating, and there are very few sections which would not in some way be affected, welcome such a splendid weapon as this paper provides against the older established forms of heating.

London, S.W.1, *December 30th.* R. C. SYMONDSON.

Air Transport for Urgent Orders

Has it occurred to the suppliers of electrical parts, replacements and machinery that the common complaint abroad and in the British Colonies about having to wait months for any replacement from England whilst the mechanism has to stand idle need not now apply if they arrange to send the replacement parts by the many air services now running?

Trade lists issued to the British Colonies and abroad should state the trade price of each article, a code number or name to save expense when telegraphing, and also the weight of the complete package for dispatch, and a note drawing attention to the possibility of telegraphing and using air lines for delivery of any part or replacement and air line charges from the factory or warehouse. This would obviate many of the delays and mistakes which now occur. S. W. UPJOHN.

Colchester, *December 30th.*

Reducing Voltage to Earth

Under the above heading Mr. W. A. Joynson makes a suggestion intended to remove the danger of shock to earth by means of a mid-point earth tapping on each 230-V two-wire supply, whereby the voltage to earth is reduced to 115 V.

With the usual method of star connection with the neutral point earthed, only one line of a two-wire service is at 230 V above earth, but with Mr. Joynson's arrangement both lines are placed at a potential differing by 115 V above earth, and the position would appear to be considerably worsened thereby. With the normal arrangement, switches can be placed in the live line and one can rest assured that with this switch off the circuit is at most very little above earth potential, but with the suggested modification the circuit remains at 115 V above earth. In other words, although the phase line has been reduced to 115 V, the neutral has been raised to a like level.

Even a shock at 115 V cannot be faced with equanimity, in view of the fact that it has been established that human beings must not be exposed to a higher pressure than about 40 V a.c., and animals to 20 V a.c. without serious risk being introduced. I quite agree with Mr. Joynson's remarks concerning the unreliability of earthing, but I cannot see that his suggested arrangement is any improvement on existing conditions, especially as it involves a departure from standard practice. Mr. Joynson will find from reference to American statistics that the number of domestic fatalities is about on a level with our own, and practically all American distribution is at 230/115 V, single-phase, with mid-point earthed.

Folkestone, *December 31st.* T. C. GILBERT.

A Salary Question

It is interesting to note the boycotting of the appointment of electrical engineer and manager to the Borough of Haslingden, and it would appear that there is a determined effort to reduce salaries still further on the part of some authorities.

It is only about twelve months since the position was advertised at a commencing salary of £50 per year more than is offered for the position to-day. Surely, as the position is a dual one the salary is totally inadequate. I am further at a loss to understand why the electrical associations did not raise their voices on the previous occasion for the salary was below that of a deputy chief official. It would appear that they only become alarmed when the salaries are getting to zero. If there were only a little more loyalty, what a lot could be accomplished, but how can one be loyal when the following is within my own experience?

Out of eight on a short list for a boycotted position seven were members of an association and the successful applicant was not a member of that particular association. Who were the most disloyal—the successful applicant or the seven, any one of whom was prepared to take the post if chosen?

December 23rd. SPARKS.

A Progressive Small Undertaking

The Carrickfergus U.D.C. electricity scheme is developing in a very satisfactory manner, and the following information may be of interest. The population of the area is approximately 7,000. In twelve months 1,200 service connections have been made, and over 200 cookers have been installed under a hiring scheme. It is expected that when the figures of the first year's working are published in March, the load and diversity factors will be of an extremely satisfactory nature. Northern Ireland, though only recently developing in the direction of rural electrification, may yet show efficiency figures comparable with any undertaking in the United Kingdom; at least that is the aim of the several authorities now distributing in the area.

Water heating is also receiving attention, and a special off-peak tariff is available. The system throughout includes a sixth core in the cables and overhead lines, controlled by time switches in the sub-stations, thus obviating the need for separate time switches for each consumer. I believe that Carrickfergus is the second undertaking in the world to employ this system. JAMES SCOTT,

Carrickfergus, *December 29th.* *Engineer and Manager.*

Contactor Starters

I should be glad of your readers' experiences in the use of contactor gear. A number of reputable switchgear makers market this line in as nearly perfect a design as possible, but, speaking generally, it is more expensive than the hand-operated type, and does not seem to be so robust. Admitting that there are a few situations where contactor gear is essential (lifts and other forms of essential remote control), what advantage is there in installing automatic instead of manually operated gear?

Consider the simple direct-on starter. The automatic model appears to be slightly cheaper than the hand-operated pattern, but the latter, especially the oil-immersed type, is very much more robust. There is nothing to choose in the ease of operation with either skilled or unskilled labour. Again, the thermal overload devices fitted to the cheaper contactor breakers, although excellent in principle, seem to me very much less robust in practice (due, probably, to the deterioration of the metals and the necessity for an extremely light structure) than the solenoid type, which for this reason is less likely to go wrong. With the latter a plunger is used to trip the breaker or starter, and its operation is very definite. Apart from cost there appear to be many points in favour of the manual direct-on starter. I should be grateful for any details of users' experiences.

December 29th. DILEMMA.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

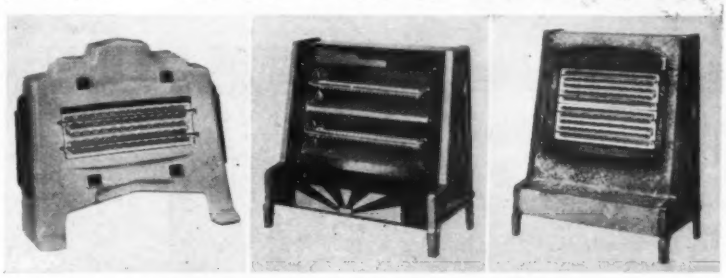
Developments in Electric Fires

Several new fires have been brought out recently by BRITISH NATIONAL ELECTRICS, LTD., Mossend, Lanarkshire, and 28, Victoria street, S.W.1.

The "Solus" has a horizontal upright fire-bar set in the front of a plain, smooth-surfaced oxidised copper or silver frame. The 1-kW model costs 15s. and the 2-kW model 22s. 6d.

Another newcomer is the "Sphinx," which is obtainable loaded at 1, 2 or 3 kW for 22s. 6d., 35s. 6d., and 47s., respectively. The four small restangular blocks in the face of the frame can easily be removed to enable a trivet to be placed above or below the elements. This trivet can be obtained for 2s.

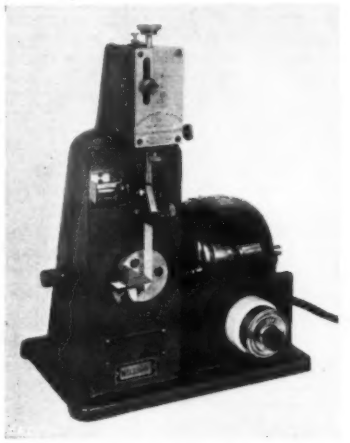
Two other new models are the "Floodheat"—a 1½-kW fire priced at £2 10s.—which has a finish in black with bright relief; and the "Fullwood," a 2-kW model obtainable at from £2 10s. to £4 5s. according to finish.



The "Sphinx," "Floodheat" and "Fullwood" fires

A Paper Testing Machine

The "M.I.T." folding endurance paper tester which we saw recently in the works at Levenshulme, Manchester, of MESSRS. EDWARD G. HERBERT, LTD., is of electrical interest not only because of its incorporated drive, but because of its application to an important electrical material.



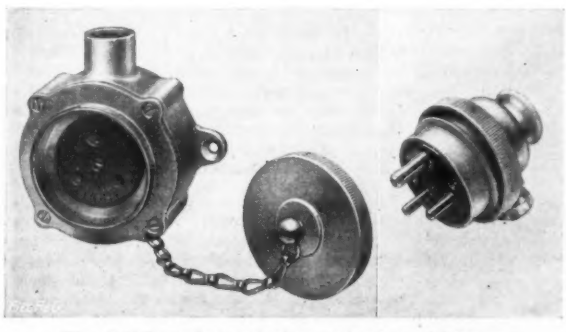
The "M.I.T." insulating-paper testing machine

The machine was designed primarily for testing insulating paper, but it can also be used for testing any other kind of paper within its capacity. It measures 12 in. long by 10 in. wide by 16 in. high. Strips of paper 1.5 cm. wide are clamped between two jaws, the lower of which rotates through a given angle, and the paper is thus folded forward and backward around a certain radius. The upper head is attached to a weighing system, so that a definite tensile load may be applied to the sample during the folding operation. A counter is provided for noting the number of folds required to cause rupture of the specimen under the conditions applied, and the counter, as well as the machine, is automatically stopped when the specimen breaks.

A Watertight Wall Socket and Plug

A new type of watertight wall socket and plug which complies with B.S.S. No. 372 and the requirements of the Home Office authorities for three-pin sockets and plugs has been introduced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, for connecting portable tools, &c., in workshops and garages.

The socket portion consists of a 5-A three-pin-and-earth type porcelain interior with "Bakelite" moulded disc mounted in a circular conduit box. A screw-down cast brass cover, attached by means of a chain, is provided so that watertight protection can be given to the socket when the plug is withdrawn. The plug is robust in design and is fitted with



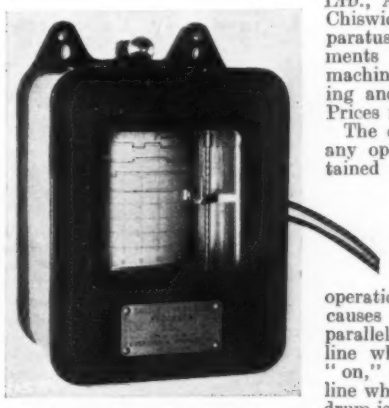
The G.E.C. socket and plug with plug withdrawn

a loose clamping ring with which it can be held in position to prevent accidental withdrawal, and at the same time remain watertight; it is also fitted with a substantial gland for gripping the flexible conductor. The conduit box can be tapped to accommodate either ¾ in. or ¾ in. screwed barrel.

The complete fitting is finished in "Silverlac" giving a clean, light, silver grey appearance, which is particularly attractive when used on a white or light-coloured background.

A Single Operation Recorder

Particulars are now available of a new "Megger" single operation recorder made by MESSRS. EVERSHED AND VIGNOLES, LTD., Acton Lane Works, Chiswick, W.4. This apparatus records the movements of electrical machines, thus ascertaining and controlling costs. Prices range from £8.



The "Megger" recorder

The complete history of any operation can be obtained on a single chart, 2½ in. by 8 in., a considerable portion of which is visible through the window of the case. The operation of the solenoid causes a pen to draw a parallel line above the day line when the circuit is "on," and below the day line when it is "off." The drum is driven by a simple eight-day spring clock which is arranged to give a speed of ½ in. per hour.

Dual-wattage Lamps

We are informed by Messrs. SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38-39, Upper Thames Street, E.C.4, that they are now supplying an opal electric lamp embodying a switch in the cap to give a wattage of 4 or 25. These "Varyalite" lamps are priced at 5s. each, and are available for voltages of 100/130 or 200/260. The switch is controlled by means of two cords.

The "Varyalite" lamp

A Transformer Oil Purifier

Under the name "Vacuum Ultra Filtre," the SOCIÉTÉ M.A.X.E.I., Neuilly-sur-Seine, France, has recently introduced a transformer oil purifying apparatus. This machine is stated to work at a comparatively low temperature—from 158 to 176 deg. F.—under an almost complete vacuum; it is also claimed not to oxidise the oil, to regenerate oil that is even normally acid, and to deliver an oil which will not give rise to further deposits. The new filter is also said to require no changing of the filtering elements nor any cleaning of plates.

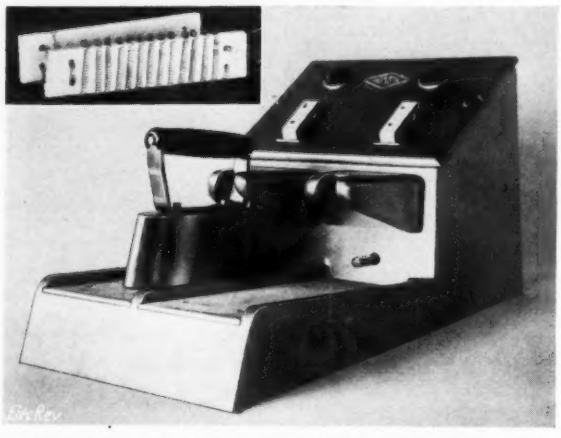
Flexless Irons

The MODINSTAL ELECTRIC CO., 1, King Street, Acton, W.3, has introduced an automatic iron reheating control panel, which is neatly cast in one piece with a sloping desk-type front on which are mounted an indicating lamp and separate fuse for each iron, and asbestos covered wire is used. When an iron requires to be reheated it is placed upon a well-ventilated asbestos-covered platform, which is sloped so that slight pressure suffices to move the iron backwards into self-aligning contacts. This movement operates a steel plunger switch, so that contact is not made or broken on the spring contact clips until the iron has operated the switch. The spring contacts engage with terminal lugs on the iron, which are vertical, so as to avoid catching in or damaging the material being ironed.

The live spring contacts are hooded for safety; there is no arcing, as the circuit is not broken externally; and energy consumption ceases on withdrawal of the iron. The panel can be

produced on the unit principle, and it is screwed at the back for the attachment of conduit.

The irons themselves can be of any size and shape and are constructed for heat storage, without mica insulation. The spiral element is wound on asbestos and arranged in one continuous length within the sole plate, which is then filled with a special cement. When dry it forms a solid

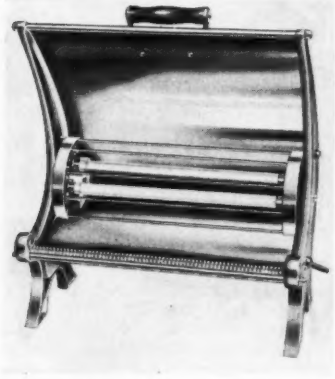


A " Hot Mass " iron and control panel (Inset: A piece of the element)

brick-like mass in which the resistance heating element is embedded. The handle is insulated with asbestos.

These " Hot Mass " irons are available in sizes from 6 lb., 400-W, 6.5 in. long and 4 in. wide at 30s. each, to 17 lb., 600-W, 10in. long and 3.5in. wide at 68s. 6d. each.

An Electric Card-shuffling Machine

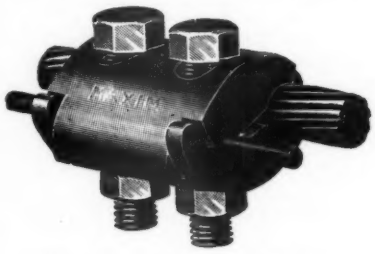


The " Victor," a new model available at £2 10s. from the Edison Swan Electric Co., Ltd., 123, Queen Victoria Street, E.C.4

Soon it seems we shall be able to sit back in our armchairs and let a machine play our bridge for us; already we can be relieved of the shuffling part of it. A few days ago we visited MESSRS. SELFRIDGE'S stores in Oxford Street, W., to inspect an ingenious machine, made in Chicago by the Hammond Electric Clock Co. A pack of cards is placed in a holder, and a button pressed. The cards are driven round in a circle by a small motor, and a few dropped at irregular intervals into four slots. When the last card is deposited the machine stops automatically leaving thirteen in each of the four slots. The apparatus is about one yard square and can be operated on ordinary domestic supplies.

" Maxim " Line Clamps

The ELECTRICAL EQUIPMENT & CARBON CO., LTD., 107, New Oxford Street, W.C.1, is now marketing a new " Maxim " line clamp supplied with silicon bronze nuts and bolts. Prices range from £1 10s. 9d. per hundred to £8 per hundred according to size; the largest size is fitted with two bolts, and the others with one.



The largest " Maxim " line clamp

A " Bakelite " Miniature Electric Torch

A " Magnet " miniature torch

A miniature type of " Bakelite " electric torch has been added to the range marketed by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2. It can be easily carried in the pocket or in a lady's hand-bag and the case, besides being more durable than the customary metal case, has the outstanding advantage of high insulation resistance. The variegated colouring of the case is pleasing and is retained indefinitely.

The new torch is like those previously marketed, cylindrical in shape, but has an octagonal cap and expanded base. A sliding switch ensures a good contact, while a new type of reflector which screws into the cap serves the dual purpose of firmly securing both the reflector and lens in position.

The dimensions of the torch are 4½ in. by 1⅜ in., and the price (including 2.5 V spot-light bulb and 3 V battery) is 1s. 6d.

A Mechanical Hammer

The " Quead " mechanical hammer is a device which should be of considerable interest to contractors. It is designed for drilling holes for wall plugs, and combines a drill, a hammer head and worm which raises and releases the hammer head, at the same time rotating the drill. By use of a strong spring moving through a short distance, regular and uniform blows are imparted at the rate of 1,000 to 2,000 per minute. All the wearing parts are of case-hardened steel and the makers are MESSRS. W. GEIPEL, LTD., 156-170, Bermondsey Street, S.E.1. The price is 12s. 6d.

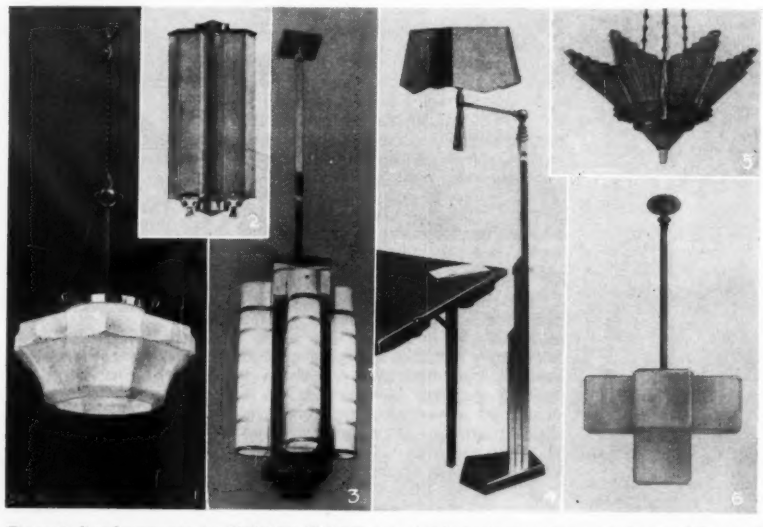
The " Quead " hammer

Large Radio Valves

Modern cooled-anode radio transmitting valves represent a considerable advance in thermionics. The M.O. VALVE CO., LTD., Brook Green, Hammersmith, W.6, makes some 250 different types of valves and one of its latest products (the result of development at the G.E.C. research laboratories) is a 500-kW transmitter which is 45 in. high, weighs 75 lb., and is believed to be the largest single unit sealed-off valve in the world. It has the following characteristics: Ef=32.5 V, If=460 A, Ea (max.)=20,000 V, M=45, m/R (mA per V)=50, max. anode dissipation=160 kW.

Short-wave communication necessitates the use of special valves, such as the cooled-anode type " CAT.9 " for use down to 15 metres and type " CAT.4 " down to 7 metres. Another noteworthy product is the split-anode magnetron type " E.396," which is primarily intended for use as an ultra-short-wave oscillator, but it is capable of producing oscillations from the lowest audio-frequencies to approximately 300×10^6 cycles (one metre wavelength), the valve being operated between the poles of an electromagnet. It can also be employed as an electronic oscillator for wavelengths down to 20 cm., its characteristics being: Ef=3 to 4 V, If=2.5 A, Ea (max.)=1,200 V, Ia (max.)=80 mA, max. anode dissipation=50 W. The max. magnetic field required is 1,000 oersteds (lines per sq. cm.) and its power output varies from 50 W at 10 metres down to 10 W at 1 metre wavelength.

There is now a complete range of d.c. mains valves rated at 0.25 at 16 V.



Recent developments in lighting fittings: 1. " Vitreosil " octagonal bowl (Thermal Syndicate, Ltd., Wallsend-on-Tyne). 2 & 4. Modern wall fitting and chromium-plated floor standard (Sun Electrical Co., Ltd., 118, Charing Cross, W.C.2). 3, 5 and 6. Three G.E.C. fittings—F.9721, with etched glassware in white, amber or pink; F.9752 with opal glass and chromium plate; and F.9681, with satin silver finish

Materials for the Electrical Industry. By L. H. Quin

A review of the position during 1932

THE past year has been most unsatisfactory for the copper industry at both the producing and consuming ends. For the most part manufacturers have had to be content with a restricted volume of orders, whilst producers have failed to put their house in order. At the beginning of the year production was curtailed to 26½ per cent. of capacity, and on April 1st it was reduced to 20 per cent., but even this drastic cut barely brought about equilibrium with consumption and did nothing at all to lighten the burden of upwards of three-quarters of a million tons of stocks, much of which was accumulated at high prices.

The situation became more involved by the introduction of a duty of 4 cents per lb. on copper imported into the United States, and by the granting by the French Government of a preference of 2 per cent. on Belgian copper. The waning control of Copper Exporters, Inc., the dominant factor, over the selling policy of producers broke down completely shortly after the introduction of the American tariff, when many of the leading interests withdrew from that body. The Ottawa agreements provided for a duty of 2d. per lb., on non-Empire copper imported into the United Kingdom, but this was later confined to electrolytic copper, and so far has not actually been imposed.

Prices throughout the year have ruled at low levels, most of the time at a figure which involved many producers in a loss, although the remarkable reductions made in costs at certain properties is an outstanding feature of the copper industry. Towards the end of the year efforts were made to arrive at co-operation in the matter of production curtailment and sales, but they came to nothing, and the outlook at the moment is very obscure, but, on the whole, not favourable. The various duties and exchange restrictions have naturally proved very serious checks to the development of business, and unless a number of mines close down fairly soon, there seems a possibility of the stocks, already immense, becoming still larger. Everything depends, now, upon whether trade revives, and pending this the market appears to have troublous times ahead.

Tin

Whilst the second half of 1932 witnessed a much better price for this commodity than earlier in the year, this was only achieved at the expense of very serious restrictions upon producers, coupled with artificial support of the market in the shape of an international pool, which has held 21,000 tons of metal off the market almost throughout the year, and with spasmodic heavy buying in the open market by a secondary pool.

The output quotas of producers comprised in the Government-controlled output restriction scheme (covering Malaya, Bolivia, Nigeria, the Dutch East Indies, and Siam) were progressively reduced until from July 1st they were only 33⅓ per cent. of the agreed basis. Even then an "export holiday" was declared during July and August in an endeavour to hasten the reduction of the surplus supplies. Consumption throughout the world, however, especially in the principal market—the United States—fell to a very low level. True there was some reduction in the stocks during the year but it was comparatively trifling. The higher prices ruling in the latter half of the year have naturally encouraged production from unfettered sources.

The present output quotas hold good until June 30th, 1933, and the restriction scheme remains in force until August, 1934. Unless there is any further diminution in consumption, therefore, it is probable that next year may see some definite improvement in the statistical position. Much depends upon the United States, however, and although consumption there is less than half what it was as recently as 1929 it cannot be said that a recovery is by any means certain. Indeed, some further falling off is not out of the question.

Lead

Little encouragement can be derived from the course of events in the lead industry during the past year. On balance prices fell over £4 per ton, whilst world stocks increased by upwards of 50,000 tons. The decline in consumption in the United States continued, and there was also a falling away in Europe, the takings of consumers in this country having begun to diminish after keeping up remarkably well. The cable trade has probably shown the biggest falling away, although battery makers have also suffered.

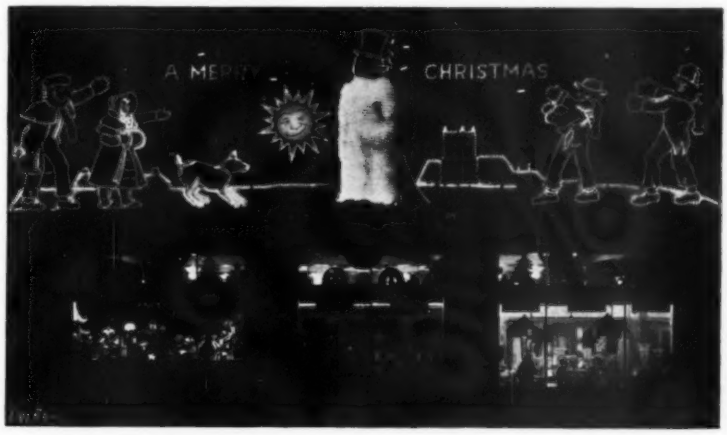
In June the European selling pool was dissolved owing to the difficulties caused by the tariff on non-Empire lead imported into this country. Producers continue to carry the bulk of the stocks and considering their size it is somewhat surprising that they are held off the market so well. Nevertheless the existence of 500,000 tons of surplus metal must remain a menace to any recovery, since at the present time production still exceeds consumption, although the margin is probably not very wide.

Looking forward it seems that better times for lead are contingent upon a recovery in general industrial activity. When this occurs lead is expected to benefit quickly. Leading interests are probably strong enough, and certainly willing enough, to facilitate a recovery in prices.

Spelter

From the statistical point of view spelter has given a better account of itself during the past twelve months than any other of the major non-ferrous metals. The situation was, however, so adverse that although the International Cartel stocks were reduced by 39,178 tons, in the first eleven months of 1932 they remain at a pretty full figure (144,667 tons according to the last returns). Output during the first seven months of the year was at 50 per cent. of the agreed basis, but from August 1st it was reduced to the present 45 per cent.

Until the galvanising industry and the brass trade improve spelter producing must remain depressed. The imposition of a 10 per cent. *ad valorem* duty on non-Empire spelter dating from March 1st last led to appreciable premiums being demanded for Empire metal for a time, but with London still the only open market for the metal foreign supplies continued to arrive and the position became more favourable for consumers.



This amusing animated sign at Messrs. Lewis's, Ltd., Leeds, is nearly 100 ft. long and utilises 4,000 lamps. It was designed and constructed by Messrs. T. Robinson, the equipment comprising "Beeantee" lampholders and 3,000 yd. of cable, Dominion Electric Co.'s lamps, and Austin Walters & Sons' controls.

The International Cartel is understood to have been renewed, but the negotiations towards this end were not altogether harmonious and are not definitely concluded. With the statistical position under control, however, an improvement in general industrial conditions seems all that is needed to set spelter on its feet again.

Rubber

The remarkable way in which costs of production have been reduced is one of the outstanding features of rubber during the year. Costs as low as 2¼d. and even 2¼d. per lb. c.i.f. are claimed by some of the best estates. Production has been curtailed owing to the low prices prevailing, especially among native producers in the Dutch East Indies.

Consumption in the United States has been very bad, but on the other hand in Europe there has actually been an increase, Russia in particular having made big strides recently. The position has been strengthened by consumption being less concentrated in one country as formerly, and by the fact that tyres no longer absorb such a large proportion of the total supplies. The latter factor is, of course, largely explained by the very low price. Stocks in the United Kingdom have been reduced by upwards of 33,000 tons during 1932, and statistically, rubber is better placed than for some little time.

The outlook is governed very largely, of course, by the general industrial situation, the automobile industry remaining much affected by general prosperity or otherwise. However, now that costs of production have been drastically reduced, cable makers are inclined to use more rubber. Generally speaking, some improvement is anticipated during the next twelve months, although progress is likely to be slow.

United States Electrical Exports

THE Department of Commerce at Washington has recently published the annual statement for 1931 of the foreign commerce of the United States. From it have been taken the following figures showing the value of the exports of nearly all the principal classes of electrical machinery and apparatus in that year, together with the more notable countries of destination. The total value of electrical machinery and apparatus exported from the United States fell from $118,260,000 in 1930 to $85,373,000 in 1931. Exports to the United Kingdom were $8,609,000 in value in 1930, and $8,870,000 in 1931; those to Canada $30,752,000 and $18,335,000; those to India $2,597,000 and $1,575,000; those to Australia $2,887,000 and $950,000; those to New Zealand $2,029,000 and $1,145,000; and those to South Africa $2,293,000 and $2,544,000. The foregoing figures do not include cable and wire, which are classified separately.

	1931. $ (Thous.)	Inc or dec. as compared with 1930.
Generators—		
Direct current—		
Under 500 kW, Total...	288	− 456
To Spain	21	+ 16
„ Canada	75	− 155
500 kW and over, Total	187	− 273
To United Kingdom ...	22	+ 22
„ Newfoundland ...	62	− 58
„ Colombia	65	+ 65
Alternating current—		
Under 2,000 kVA, Total	137	− 173
2,000 kVA. and over Total...	1,370	+ 710
To Soviet Russia... ...	1,303	− 1,300
Steam turbine generator sets—		
Total	1,024	− 576
To Germany...	49	+ 34
„ Canada	48	− 132
„ Mexico	43	− —
„ Newfoundland	62	+ 62
„ Argentina	749	+ 190
Accessories and parts for generators—		
Total	1,118	+ 408
Arc welding sets—		
Total	540	+ 100
To France	27	− 1
„ Soviet Russia	203	+ 143
„ United Kingdom ...	88	+ 71
„ Canada	63	− 87
„ Japan	37	+ 3
Self-contained lighting outfits—		
Total	340	− 500
To United Kingdom ...	100	− 40
„ Canada	46	− 50
Batteries—		
6-V storage batteries*—		
Total	1,466	− 344
To Java	56	− 1
„ Argentina	197	− 92
„ Brazil	68	− 30
„ India	160	− 10
„ S. Africa	156	− 46
Other storage batteries—		
Total	710	− 590
To United Kingdom ...	56	− 64
„ Canada	82	− 168
„ Mexico	73	− 4
„ Chile	156	− 35
„ S. Africa...	64	− 52
No. 6 dry-cell batteries—		
Total	450	− 130
Flash-light batteries—		
Total	2,600	− 1,020
To United Kingdom ...	182	+ 123
„ Argentina	177	− 102
„ India	425	− 134
„ Malaya	223	− 156
„ China	340	− 220
„ Java	175	− 27
„ Dutch E. Indies... ...	157	+ 5
„ Hong-Kong	204	− 181
Radio B. and C. batteries (dry)—		
Total	325	− 253
To United Kingdom ...	28	− 7
„ Argentina	106	− 119
„ New Zealand	38	− 41
„ S. Africa...	26	− 6
Other dry and wet cell primary batteries—		
Total	110	− 157
Power transformers, 500 kVA and over—		
Total	807	− 1,203
To Soviet Russia	533	− 177
„ Spain	68	− 24
„ Argentina	49	− 174
„ Venezuela	32	+ 30
Distribution transformers less than 500 kVA—		
Total	570	− 1,290
To Mexico	125	− 85
„ Argentina	95	− 116
„ Brazil	55	− 302
„ Venezuela	40	− 58
Instrument transformers—		
Total	156	− 84
To Soviet Russia	35	+ 31
„ Brazil	28	− 37
Other transformers—		
Total	490	− 690
To Canada	126	− 134
„ Mexico	43	− 195
„ Argentina	39	+ 27
„ Chile	62	+ 31
„ China	30	− 1
„ S. Africa...	22	− 24
Double-current and motor generators, converters, etc.—		
Total	1,150	—
To France	34	+ 30
„ Japan	64	+ 40
„ Soviet Russia	145	+ 75
„ Canada	290	− 30
„ Argentina	94	− 34
„ Chile	72	− 41
Switchboard panels except telephone—		
Total	1,710	− 450
To Italy	130	+ 77
„ Soviet Russia	310	− 70
„ Canada	120	− 95
„ Mexico	90	− 45
„ Argentina	90	− 100
„ Chile	530	+ 483
Power switches and circuit breakers over 10-A—		
Total	1,290	− 1,100
To Soviet Russia	470	+ 100
„ Canada	240	− 480
„ Dutch West Indies ...	44	+ 43
„ Mexico	78	− 192
„ Argentina	43	− 70
Fuses—		
Total	186	− 194
To Canada	56	− 76
Watt hour and other measuring meters—		
Total	570	− 160
To Mexico	80	− 10
„ Brazil	60	− 15
„ Chile	69	+ 36
„ China	53	+ 45
Indicating instruments—		
Total	530	− 300
To Italy	44	− 4
„ Soviet Russia	43	− 33
„ United Kingdom ...	48	− 62
„ Canada	140	− 50
„ Japan	39	− 73
Recording instruments—		
Total	303	− 147
To France	28	− 6
„ Soviet Russia	56	+ 32
„ Canada	43	− 47
Other testing apparatus—		
Total	636	− 284
To Canada	260	− 160
Lightning arrestors, choke coils, etc.—		
Total	610	− 210
To Soviet Russia	45	+ 19
„ Spain	65	− 10
„ Canada	90	+ 5
„ Japan	80	− 60
Motors, ½ h.p. and under—		
Total	1,490	− 920
To France	140	− 25
„ Germany...	95	− 105
„ United Kingdom ...	250	− 200
„ Canada	480	− 100
„ Argentina	75	− 29
Motors over ½ and under 1 h.p.—		
Total	335	− 325
To United Kingdom ...	80	− 22
„ Canada	100	− 110
Stationary motors, 1–200 h.p.—		
Total	1,490	− 1,900
To Soviet Russia	200	− 420
„ United Kingdom ...	220	+ 15
„ Canada	250	− 430
„ Mexico	120	− 210
„ Chile	110	− 150
Stationary motors over 200 h.p.—		
Total	645	− 45
To Soviet Russia	420	+ 145
Railway motors—		
Total	180	− 19
To Spain	55	+ 37
Electric locos., railway—		
Total	170	− 700
To Canada	100	+ 92
„ Chile	60	− 746
Electric locos., mining and industrial—		
Total	440	− 300
To Canada	60	− 130
„ Chile	155	+ 65
Electric trucks—		
Total	220	− 59
To Soviet Russia	120	− 40
„ United Kingdom ...	30	+ 18
Starting and controlling equipment for industrial motors—		
Total	1,260	− 390
To France	66	+ 39
„ Soviet Russia	220	+ 124
„ United Kingdom ...	90	− 60
„ Canada	400	− 450
„ Mexico	70	− 11
„ Chile	85	+ 2
For railway and vehicle motors—		
Total	195	+ 95
To Spain	90	+ 82
„ United Kingdom ...	12	+ 10
Portable electric tools—		
Total	785	− 421
To France	40	− 53
„ Soviet Russia	140	+ 75
„ United Kingdom ...	310	− 130
„ Canada	90	− 80
Accessories and parts for motors—		
Total	1,760	− 650
Household refrigerators—		
Total	6,860	− 1,380
To Belgium	560	− 130
„ France	260	− 130
„ Sweden	120	− 10
„ Switzerland	160	− 30
„ United Kingdom ...	700	− 150
„ Canada	1,580	+ 335
„ Mexico	215	− 15
„ Argentina	218	− 132
„ Brazil	240	+ 70
„ South Africa	560	+ 170
„ Japan	180	+ 60
Commercial refrigerators—		
Total	1,770	− 290
„ France	180	+ 100
„ United Kingdom ...	250	+ 20
„ Canada	470	− 180
Electric fans—		
Total	435	− 615
To Canada	100	− 70
Incandescent lamps for automobiles, flashlights, etc.—		
Total	215	+ 20
Other metal filament—		
Total	600	− 420
To Mexico	39	− 71
„ Argentina	55	− 8
„ Chile	88	− 10
Other lamps—		
Total	90	− 180
Household washing machines—		
Total	870	− 840
To Germany...	53	− 112
„ United Kingdom ...	250	− 53
„ Canada	335	− 565
Domestic vacuum cleaners—		
Total	1,180	− 540
To United Kingdom ...	710	− 355
„ Canada	315	+ 15
Flatirons—		
Total	200	− 75
Cooking ranges—		
Total	410	− 35
To Argentina	85	− 47
Electric furnaces, etc.—		
Total	900	+ 40
To Soviet Russia	365	− 21
„ Canada	170	+ 84
X-ray apparatus, etc.—		
Total	1,120	− 480
To United Kingdom ...	60	− 30
„ Canada	500	− 115
Radio apparatus—		
Transmitting sets, tubes and parts—		
Total	805	− 335
To Italy	55	− 25
„ Canada	65	− 27
„ Mexico	145	+ 15
„ Brazil	90	− 34
Receiving tubes—		
Total	1,950	− 410
„ France...	120	+ 70
„ Italy	210	− 110
„ United Kingdom ...	110	+ 35
„ Canada	100	− 125
„ Argentina	320	+ 40
„ Australia	300	− 25
„ New Zealand	105	− 75
Receiving sets—		
Total	14,360	+ 2,810
To Belgium	430	+ 380
„ France...	760	+ 680
„ Italy	900	− 135
„ Spain	770	+ 480
„ Switzerland	1,000	+ 865
„ United Kingdom ...	1,920	+ 1,515
„ Canada	1,560	− 1,885
„ Mexico	620	− 990
„ Argentina	1,710	+ 480
„ Uruguay	520	+ 80
„ New Zealand	610	− 30
„ South Africa ...	620	+ 430
Receiving set components—		
Total	3,890	− 490
To Canada	1,950	− 120
„ United Kingdom ...	430	+ 190
Loud speakers—		
Total	1,060	− 580
To France...	175	+ 65
„ United Kingdom ...	120	+ 10
„ Canada	170	− 200
Telegraph apparatus—		
Total	310	− 455
To Canada	65	− 200
„ United Kingdom ...	36	+ 12
Telephone instruments—		
Total	320	− 210
To Canada	115	− 55
Telephone switchboards—		
Total	90	− 860
Other telephone equipment—		
Total	1,470	− 2,420
To Canada	840	− 1,410
Insulating material—		
Total	560	− 560
To United Kingdom ...	180	− 110
„ Canada	115	− 185
Metal conduit and switch boxes—		
Total	580	− 630
To Canada	140	− 80
„ Mexico	65	− 110
„ Argentina	70	− 120
Lighting switches, sockets, etc.—		
Total	1,370	− 430
To Canada	450	− 130
Insulated iron or steel wire and cable—		
Total	108	− 108
Rubber covered copper wire—		
Total	449	− 471
Telephone cable—		
Total	136	− 140
Other insulated copper wire—		
Total	1,706	− 1,414
To United Kingdom ...	298	− 71
„ Canada	173	− 397
„ Chile	343	+ 163

* Included 12-V storage batteries in 1931.

Electrical Export Trade. By Exporter

Altered circumstances justifying intensified effort

AT the beginning of any new year the mind is receptive toward suggestions for greater effort, but at the opening of 1933 it should be more so than usual amongst electrical manufacturers and traders. Much happened during 1932 and the changing conditions render it essential for us to be well on the look-out so that we may keep pace with events.

The British electrical trade is now a protected one and it can therefore consolidate its production with a view to supplying its own market to a degree never before possible. At the same time the world export market can also be considered. Concentration on production is advantageous for both purposes. Changed circumstances due to the Ottawa agreements must also be taken into account. Although the preference under these agreements to the electrical industry may not be very substantial, it has now been accepted by the Empire as a whole that it is advantageous to everyone to do as much mutual business as possible.

The increase in the trade in all other industries due to the Ottawa agreements is bound to improve the electrical industry, as extra production in any industry cannot be carried on without increasing the demand for additional plant and materials. Further, as reconstruction has been for so long put off in some of the heavy industries whose prospects are now a little brighter, there is the assurance that here again further electrical plant and material will be required. With a consolidation effect at home and throughout the Empire, the way is now open to an improvement in foreign trade outside the Empire agreements and one can visualise this as an international competition requiring a more unified effort in such foreign countries. The more difficult it is made for the foreign manufacturers to do business in the Dominions, the more it will intensify their efforts in the neutral markets.

A Well-organised Industry

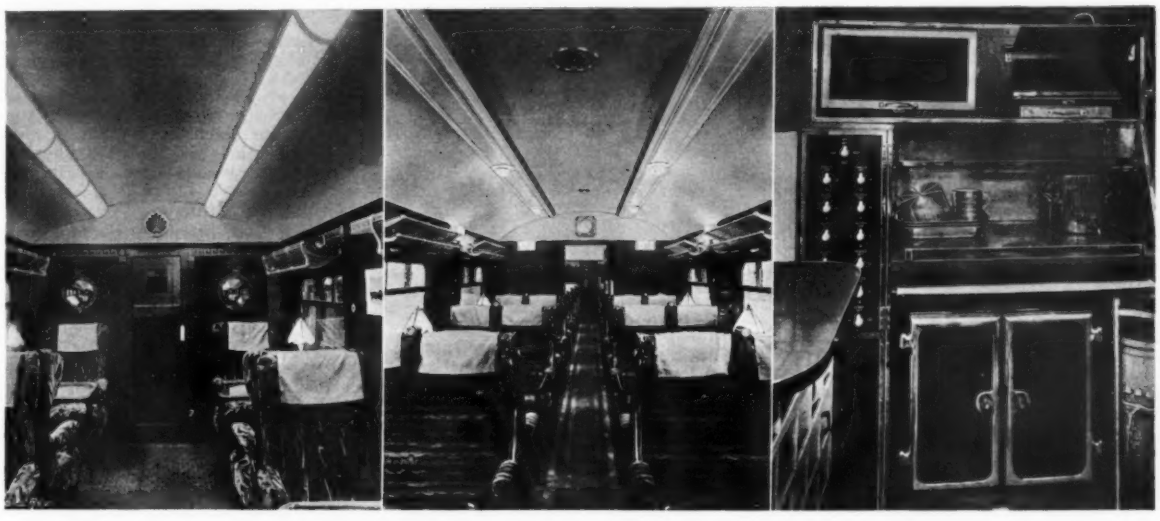
The British electrical trade is fortunate in that it is the best-organised British trade and possesses active associations through which co-operation can be promoted. As examples we have the B.E.A.M.A. and the C.M.A. The initials C.M.A. are now known as the mark of quality for cables throughout the world. Would it not be a wise step for the B.E.A.M.A. to make a similar use of its initials to denote the hall-mark of quality for British productions in electrical plant and materials? What do readers think of this proposition?

In considering the altered position it is advantageous to look far enough ahead so that we can get one focal point on which all beams can be concentrated. There are certain essential points to bear in mind in order to put us in a better position in neutral countries. These are known to many traders and if they were adopted, I believe that they would enable British manufacturers to compete against the unified competition of American and German makers who provide these facilities wherever they establish themselves seriously to carry on trade. The increased share of business obtained by the employment of unified up-to-date trading methods should compensate firms co-operating to this end by each one obtaining a larger turnover at a better profit than is possible under present conditions. Manufacturers participating in joint efforts would be able to appoint more trained representatives, each one being a specialist in his own line. The reduction in the proportion represented by the selling expenses represents an increase of profit to the manufacturer, or, conversely, enables him to quote a lower price.

The Central Board's Example

Let us take as an example the operations of the Central Electricity Board in controlling electricity supply in Great Britain. The justification for these efforts is claimed to be that the unification of supply and the control of the stations producing electricity will more than compensate for the additional cost incurred in constructing the grid, and will have the effect of bringing down the cost to large consumers. Is not this exactly what the electrical trade requires in connection with the selling of its own products?

In considering salesmanship everywhere one must bear in mind the very important change that is taking place in the electrical industry generally, due to the increase in the size and the decrease in the number of generating units. The proportion of money spent in the purchase of these is growing less and less as compared with that spent on current-consuming devices. The purchase of the latter is in the hands of the public generally, therefore the same methods cannot be applied for these sales as for the sale of generating plant and power equipments to a relatively small number of customers well acquainted with the technique of such plant. The appeal, therefore, has to be to a much wider clientèle which is so far necessarily only slightly acquainted with electricity in general.



New rolling stock on the London-Brighton electric service (see page 22). Left: A first-class compartment. Centre: Third-class accommodation. Right: The cooking equipment.

Temperature Measurements in Heating Elements

A communication from the research department of the Technische Hochschule, Hanover, contains valuable information concerning the temperature-resistance characteristics, at temperatures up to 1,200-1,275 deg. C., of various alloys used for embedded heating elements. A summary of the data is given in a recent issue of *Elektrotechnische Zeitschrift*. The temperature coefficient of resistance of nichrome averages 1 by 10^{-4} per deg. C. between 20 and 500 deg. C.; also, the temperature-resistance curves of certain nickel-chromium alloys show an undulation. For these reasons it is impossible to obtain accurate and unequivocal determinations of temperature from measurements of the resistance of the wire. Subject to stated corrections, a high degree of accuracy can be obtained by substituting a platinum wire for the normal heating element. Moreover, as the temperature coefficient of resistance of platinum is high (about 4 by 10^{-3} per deg. C.) the requisite measurements can be made with commercial sub-standard instruments.

The Illuminating Engineering Society

The Illuminating Engineering Society is holding its annual dinner and dance on February 7th at the Trocadero Restaurant, W.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources, Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

The " Electrical Review " Index

The index to Vol. CXI (for the half-year ended December 31st, 1932) is in course of preparation and will be published shortly. We shall be glad to receive the names and addresses of those who require it (free of charge) for binding purposes, or wish to retain it for reference. Application should be made as early as possible to the Publisher, 4, Ludgate Hill, E.C.4.

Municipal Trading at Bolton

The Bolton Corporation Electricity Committee recently received a deputation, consisting of Mr. Wm. H. Watkinson (secretary of the Manchester branch of the Electrical Contractors' Association), Mr. H. M. Harrison (chairman of the Electrical Contractors' Section of the Bolton Chamber of Trade), and Mr. J. Parkes (secretary of the Bolton Chamber of Trade), regarding a complaint of unfair competition resulting from the Electricity Department's policy in offering for sale electrical fittings and appliances at prices less than those fixed by the manufacturers. Consideration of the matter was deferred.

" Distribution of Electricity "

The New Year number of the journal bearing this title, which is issued by W. T. Henley's Telegraph Works Co., Ltd., is an excellent production. Its cover bears a picture in colour of old London Bridge, and well-known electrical men contribute New Year messages. The special technical articles contain much sound matter. Several pages are devoted to a well-illustrated account of the Yorkshire Electric Power Co.'s system and activities from different angles and overseas electrical undertakings receive attention.

A Travellers' Conference

The annual conference of the representatives of the Mechanical Rubbers and Ebonite Goods Department of Redfern's Rubber Works, Ltd., Hyde, Ches, was held at the works on December 29th and 30th. Mr. T. H. Redfern (director) received them, and Mr. Richard Breerton, the sales manager of the Department, outlined the selling programme for next year. At the conclusion of the conference the directors entertained the travellers to luncheon and the theatre. Mr. W. B. Kelland expressed the thanks of the sales staff to the directors for their hospitality.

The Southern Railway's New Coaches

As mentioned briefly in our last issue a number of special " luxury " coaches have been constructed for use on the new London-Brighton-Worthing electrified line which was opened for public service at the beginning of this week. What are claimed to be the first all-steel all-electric Pullman cars in the world are now running on the " Southern Belle " and other express trains, and a number of pictures of the new rolling stock appear on page 21.

In the first-class Pullmans there is an attractive form of " Linolite " strip lighting on each side throughout the length

An average of six thousand persons a day visited Victoria Station last week to inspect the Southern Railway's new " Southern Belle," designed for use on the London-Brighton electrified service opened this week

of each saloon. The general effect is extremely good, and the diffusion is such that it is possible to read in comfort in any position. Advantage has been taken of small alcoves at the end of the saloons to introduce a pleasing concealed lighting effect.

In the third-class accommodation there are semi-recessed ceiling lights with tulip shades and panel-type bracket lights with decorated glass, and all the tables are equipped with table lamps. " Osram " lamps are used. A system of bells enables attendants to identify the actual passenger requiring attention. Batteries for emergency lighting have been supplied by Pritchett & Gold, and E.P.S. Co., Ltd., and Smith's synchronous electric clocks are fitted. Carriage heaters thermostatically controlled and operating at 600 V are placed between the seats.

A compact " Carron " cooker comprising a large oven, grill, hot cupboard, four small and two large boiling plates, and a four-gallon urn for tea making is situated in the kitchen.

The whole of the electrical apparatus on these new Pullmans has been supplied and installed by Messrs. J. Stone & Co., Ltd., Deptford. The traction equipment for the motor cars was supplied by the British Thomson-Houston Co., Ltd.

The Victorian Electricity Commission

Representatives of the Electrical Traders' Federation of Victoria recently held a conference with the Minister in Charge of Electrical Undertakings (Mr. Macfarlan) when they expressed the opinion that the State Electricity Commission should not be allowed to have unrestricted dealings in electrical appliances in competition with private enterprise. Mr. Macfarlan said he would ask the Cabinet for a decision. They would consider the views of the Federation and the opinions of a section of traders who are in favour of the Commission being allowed to continue this trade, in conjunction with the report on general principles by the assistant minister, Colonel H. E. Cohen. It is expected that the Cabinet will decide that the Commission should gradually abandon this part of its activities.

Conditions in Chile

A picture of economic chaos, lost international credit and greatly reduced foreign commerce is drawn by Mr. A. J. Pack, Commercial Secretary to H.M. Embassy at Santiago, in a Department of Overseas report on economic conditions in Chile up to November last. An idea of the depressed state of trade may be judged from the fact that, while exports of electrical equipment during 1931 amounted in value to 37,100,000 pesos (peso=6d.), for the first six months of 1932 they were valued at only 4,200,000 pesos. There does not appear to be a prospect of any real improvement for a long time to come.

German Cable Export Syndicate

The " Indeska " or community of interests of the German cable manufacturing works of Berlin, which was formed at the end of 1929 for the furtherance of mutual interests especially abroad, has been dissolved in so far as export business is concerned. Special difficulties have been encountered in carrying out the scheme, which included the establishment of works abroad, as the development of the general economic situation rendered it impossible to pursue the matter further. Ten cable works were members of the syndicate, which will now only be continued for the protection of their interests in the home market.

Catalogues Required

Mr. J. J. Tooby, late of the Sunderland Forge & Engineering Co., Ltd., has entered into partnership with Mr. E. H. Rake as electrical contractors and repairers of electrical machinery at the Park Lane Electrical Repair Centre, Sunderland (telephone: Sunderland 2996), and asks for manufacturers' catalogues and price lists.

A Large Works Conveying Scheme

In our December 23rd issue (p. 915) under the above title we described the electrically driven conveying system at the new factory of Messrs. Boot's Pure Drug Co., Ltd., at Beeston (Notts). Messrs. Marryat & Scott, Ltd., who were responsible for the lift installation, have now sent us an illustrated booklet entitled " The Vertical Transport of Goods," dealing with the system in some detail.

G.E.C. Development in 1932

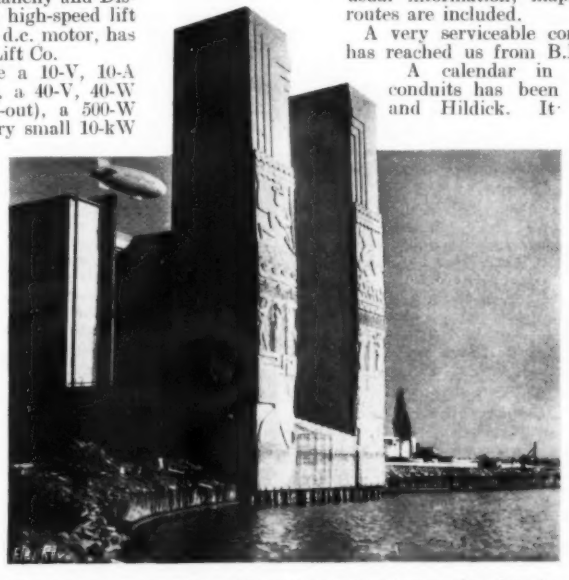
Among the most striking of the activities of the G.E.C. research laboratories during 1932 was the development of hot cathode tubes (ELEC. REV., November 11th, 1932). In addition to the lamps in use at Wembley which have an efficiency of 40 lumens per watt, a sodium lamp giving 70 lumens per watt (for an 80- or 100-W tube) has been developed for illuminating arterial roads. A new water-cooled transmitting valve, the largest of the type so far made, has a height of 45 in., and a weight of 75 lb. Photo-electric photometers have been produced which measure illumination at five times the speed of the visual photometer; a portable type measures street lighting values as low as 0.1 ft.-candle.

Contracts received by the company included the complete electrification of the *Queen of Bermuda* (including four 5,000-h.p. synchronous motors), pass-out turbo-generators (with nozzle cut-out governors), automatic rectifiers and rotary convertors for railways, and a 1,000-h.p. a.c. winder (the largest on the North-East Coast). A one-and-a-half million kVA metal-clad switchboard has been supplied

to Sheffield Corporation, and others from 250,000 to 750,000 kVA to five supply and traction undertakings. The design of the standard ranges has been simplified and fabricated steel supports are used. Outdoor switchgear has been manufactured for the grid. The McColl protective system has been applied to several 132- and 33-kVA sections of the grid. A scheme has been evolved for isolating oil-filled cables in the event of oil leakage. Contactors for winders, &c., are being made to deal with 2,000 A at 5,000 V. Transformer contracts included exports to Spain, Russia, the Far East, and the Dominions.

Motor coach equipments have been made for the Metropolitan and L.M.S. Railways; trolley-bus equipments are also under construction for the Llanelly and District E. S. Co., Ltd. A gearless high-speed lift with variable voltage control of a d.c. motor, has been introduced by the Express Lift Co.

New "Osram" lamps include a 10-V, 10-A exciter for sound reproduction, a 40-V, 40-W traction lamp (with fusible cut-out), a 500-W lamp for photography, and a very small 10-kW lamp for cinema studios. A complete change-over has been made to British illumination glassware, and many important improvements have been made in lighting fittings. Numerous street lighting schemes and luminous tube displays have been completed. In communication work the most notable developments have been the teleprinter exchange service, the "zero loss" circuit (for improving long-distance telephony) and automatic carrier current systems. In the Central England area of the grid the whole of the supervisory gear is being supplied, in addition to voice-frequency and auxiliary apparatus.



The two giant pylons which act as water towers for the electrical building at the Chicago World's Fair which opens in May

Among other notable achievements (many of which have been described in these columns) are the high-frequency and bright annealing furnaces (Greenwalde process), the application of photo-electric cells to industry, large industrial cooking installations, improvements in domestic appliances, meters and instruments, X-ray apparatus, and small switches, and the introduction of a dry cell for use in tropical countries.

Changes of Name

National Radio Electrical & Associated Services, Ltd., 32, St. Mary's Place, Newcastle-upon-Tyne, has changed its name to National Radio Electric Services, Ltd.

The Charles White Electrical Co., Ltd., 234, Upper Thames Street, E.C.4, has changed its name to the Central Wholesale Electrical Co., Ltd.

Recent Contract

The Hart Accumulator Co., Ltd., has received an order for emergency lighting equipment to be installed in the Manchester Central Library, now in course of erection. The equipment consists of a "Keepalite" automatic control panel and a 230-V storage battery of 116 cells, having a capacity of 250 Ah (ten-hour rate), with a motor generator set.

Standard Specification for Synthetic Resin

The first British Standard Specification (No. 474-1932) for synthetic resin (phenol-aldehyde) used as an adhesive insulator for the manufacture of paper boards, tubes, and cylinders limits the requirements to a few essential properties, and the methods of test as specified are as simple as practicable. For this reason an electric strength test on varnished tissue paper, the simplest form of this type of test available, is specified. The specification also covers definitions of "green" and "liquid" resin, the strength of solution which must be obtained under given conditions, tolerance on melting point (owing to the wide variation in users' requirements it is not practicable to specify a melting point), and a clause to limit the amount of untransformed resin after a given heat treatment.

Copies of the Specification may be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, S.W.1, price 2s. 2d. post free.

Calendars, Diaries, Etc.

We have received from the West Midlands Joint Electricity Authority a wall calendar bearing a picture of the Ironbridge power station.

Pictures of famous British beauty spots are used to illustrate the Power Machinery Trading Co.'s attractive calendar.

The Supra Electrical Co.'s calendar is ornamented with a brightly coloured picture entitled "The Pipes of Pan," and has large daily slips.

The Wellington Press sends us a neat easily readable calendar with monthly sheets.

There are quotations from the works of popular writers on the daily slips of Messrs. B. S. & W. Whiteley's calendar.

"Incomparable" aptly describes the auburn-haired damsel who appears on the Hart Accumulator Co.'s calendar.

Messrs. James Neill & Co. (Sheffield), Ltd., have sent us a 1933 diary which includes an atlas, maps of the London underground railways, a number of useful tables and ample space for notes. The cover is of soft leather and contains pockets for stamps, etc.

We have received from Messrs. Milne & Longbottom, Elm Works, Mere Lane, Rochdale, a neat propelling pencil.

The diary for 1933 received from Dexine, Ltd., Stratford, E.15, is bound in dark green limp leather. In addition to the usual information, maps of the London Underground routes are included.

A very serviceable combined ash-tray and pen stand has reached us from B.E.N. Patents, Ltd.

A calendar in the shape of a bundle of conduits has been received from Messrs. Hildick and Hildick. It has daily slips.

The beautiful blonde on the Concordia Electric Safety Lamp Co.'s calendar will attract much attention.

Daily slips with large figures are used for the calendar of Messrs. Barrett, Tagant & Gotts, Ltd.

The Revo Electric Co., Ltd., has sent a wall calendar with daily slips bearing 3¼-in. letters.

"The Black Shawl," a water-colour of a captivating maiden, decorates the Lancashire United Transport & Power Co.'s calendar.

The Davenport Engineering Co.'s calendar has blue daily slips on a yellow background.

B.T.-H. Technical Progress

Typical of the year's work of the British Thomson-Houston Co., Ltd., is the erection on site of the following turbo-alternators: 75,000-kW at Barking, 67,200-kW at Battersea, 30,000-kW (1,200 lb. per sq. in.) at Dagenham (Ford works), 50,000-kW at Ironbridge. The 10,000-kW, 3,600 r.p.m. set for the Detroit Edison Co. has run for 1,500 hours continuously at 1,000 deg. F. Solid rotors have been successfully tested for 3,000 r.p.m. sets—37,500 kVA at Spondon, 18,750 kVA at Norwich, and 12,500 kVA for the Northmet Co. Special voltage regulators have been introduced for base-load stations (e.g., Barking).

Five cupola blowers giving constant weight of air irrespective of changes in barometer, air temperature, or cupola resistance have been supplied to the Ford Motor Co.

Standard oil circuit breakers have been fitted with cross-jet box or oil-blast explosion-chamber gear for arc control. New lines of distribution switchgear include pole-mounted oil circuit breakers for 11, 22, and 33 kV, with automatic reclosing devices, and three-pole l.v. air circuit breakers up to 2,000 A. Orders secured include 132- and 33-kV switchgear for the South Scotland grid up to one million kVA. The transformer output has exceeded previous records, and almost all of the sixty-one transformers (114,375 kVA) for the Uhl River hydro-electric scheme have been dispatched. The last of the 132- and 33-kV transformers for the C.E.B. (total 1,116,000 kVA) has been completed. A repeat order from the Irish Free State for a 10,000-kVA 33-kV transformer with on-load tap-changing has been carried out. Rectifiers have been supplied for the Piccadilly and the Barking-Upminster railways, and also 1,500-V sets for the Shildon-Newport railway to replace the 40-cycle rotaries, which operate at low load factor. Grid control is being applied for the suppression of short-circuits to two 600-kW 20,000-V d.c. rectifiers for broadcasting. Rotary convertors have been dispatched to Lisbon, Calcutta, Buenos Aires, and Hong Kong.

More a.c. machines have been constructed than in any previous year; these include two 21,250-kVA 300-r.p.m. water-wheel alternators for the Grampian Power Co. and the 7,500 h.p. synchronous motor for the Tata Iron & Steel Co. (ELECTRICAL REVIEW, October 28th). Several shunt phase advancers, up to 3,500 h.p., are in hand. The number of sizes and types of the single-phase commutator motor has been considerably extended. A new line of 1-, 2-, and 3-h.p. repulsion induction motors has been developed and motors up to 25 h.p. at 960 r.p.m. have been supplied. The development of paper-machine drives (a.c. and d.c.) has been notable.

The B.T.-H. 35 mm. talking film equipments have been installed in India and other countries overseas. The 16 mm. reproducer has been modified to accommodate the new 16 mm. film with one row of sprocket holes, with a frequency range up to 10,000 cycles. A sound amplifying van equipped with a radio receiving set has been used extensively for temporary public address systems.

Among other important developments during the past year

have been vacuum devices, new insulating materials, electro-acoustical apparatus, high-frequency oscillators, refrigeration and electric heating and washing, thyratron valves, photo-electric cells, the "Clinker" contactless electric clock, Diesel-electric locomotives, trolley-buses (with regenerative control), d.c. crane motors, electro-plating plants, large and small variable speed a.c. commutator motors, electro-hydraulic thrustors, and fractional h.p. motors.

Trade Announcements

Standard Telephones and Cables, Ltd., St. Chad's Place, 364, Gray's Inn Road, W.C.1, inform us that they have become members of the British Radio Valve Makers' Association. All agreement holders are therefore now permitted to deal in the "Micromesh" valves manufactured by that company.

Mr. D. Winton Thorpe, A.M.I.E.E., consulting electrical engineer, has removed to 100, Victoria Street, S.W.1 (telephone: Victoria 6436).

Measurement, Ltd., has moved to Terminal House, Lower Belgrave Street, Victoria, S.W.1 (telephone: Sloane 8271/2).

Mr. O. C. Dinerman, Standard Buildings, City Square Leeds (telephone: Leeds 24605), has been appointed to represent Messrs. Laurence, Scott & Electromotors, Ltd., for the sale of motors and control gear in Yorkshire.

British National Electrics, Ltd., have just opened showrooms, stores and offices at 112, Hope Street, Glasgow, and in the near future similar premises are to be opened in Edinburgh and in Berners Street, London, all for the service of the trade.

Messrs. Santon, Ltd., have removed from Dock Street, Newport, Mon., to Somerton Works, Newport, where the whole of their manufacturing will now be carried on. The registered office of the company is also at this address.

Mr. Lind Davidson has commenced business as an electrical and wireless engineer at 34, Baron Taylor's Street, Inverness.

Messrs. Speedy & Eynon inform us that owing to the retirement of Mr. G. L. Eynon from active work after thirty-six years' partnership in the firm, the business has been formed into a limited liability company under the name of Speedy & Eynon, Ltd. (see page 32). Mr. Speedy will continue as managing director and Mr. J. W. H. Hawes will be a director. Mr. Eynon will act as secretary of the company.

A new wholesale distributing depôt for the Glasgow area has been opened by the Ever Ready Co. (Great Britain), Ltd., at 31, Cadogan Place, Glasgow. The remainder of Scotland will continue to be served from 97, Hanover Street, Edinburgh.

Social Events

The fifth annual supper and dance of the sports and social club of the West Midlands Joint Electricity Authority was held recently at the Victoria Hotel, Wolverhampton. The attendance of 140 included Messrs. S. T. Allen (Central England manager of the Central Electricity Board), F. Forrest (city electrical engineer, Birmingham), T. A. G. Margary (borough electrical engineer, Wolverhampton), E. F. Hetherington (chief engineer, W.M.J.E.A.), J. Morton (chief assistant engineer to the Authority, and chairman of the South Midland Section of the Institution of Electrical Engineers), and H. F. Carpenter (clerk and treasurer to the Authority).

Mr. S. E. Britton, borough electrical engineer, presiding at the recent annual staff dinner of the Chester electricity undertaking, said that the past twelve months had produced a few more records in the history of the undertaking. It was the 37th year of its existence, and during the twelve months 1,200 new consumers had been connected to the supply, and the total now exceeded 10,000. The maximum demand was more than 7,000 kW, and 13,000,000 kWh had been sold. During the past week or two the Corporation had had to make a connection with the Central Electricity Board's grid system and the Mersey Power Co. That was only temporary, but in the course of time they would be permanently connected to the grid. Electricity undertakings did not exist to relieve rates. Their purpose was to supply cheap electricity and give efficient service, and in that way benefit the community. The more it became a national service the less chance was there of it becoming a revenue-making concern for rate relief purposes.

Messrs. J. H. Tucker & Co., Ltd., held their annual social recently; this event took the form of a Christmas dinner followed by a concert and dancing. A large gathering, representing every section of the company, attended. Mr. E. K. Muir, the general sales manager, conveyed the directors' Christmas wishes to the staff, and expressed the hope that the prosperity of the company would considerably improve with the trade revival which could not much longer remain overdue.

The annual staff dinner of Jackson Boilers, Ltd., was held at the Queen's Hotel, Leeds, on December 29th. In proposing the toast of the company, Mr. S. Maddock (London manager) said that excellent results obtained by the company during the year had been gained only by good management, workmanship, and salesmanship. Mr. J. H. N. Peel (chairman), in responding, said the turnover during the past year showed an increase of rather more than 1¼ per cent. on that of the preceding year, and once again they were able to pay the workers the usual profit-sharing bonus. Mr. A. G. Barrow (managing director) and Mr. A. W. Warrington (director) also spoke.

Meter Production in Poland

The production of electric meters has considerably increased in Poland in recent years, and the number of factories producing them has grown from one to three. The number manufactured in 1929 was barely 8,000. In 1930 it was increased to 10,500, and to 43,000 in 1931, while the total for the first ten months of 1932 was 56,000.

The Trevithick Centenary

Richard Trevithick is chiefly remembered as the pioneer of "high-pressure" steam. His predecessors, Newcomen & Watt, had designed engines to work at a pressure rarely exceeding 5 lb. per sq. in. and exhausting to a condenser. Trevithick raised the pressure twenty-fold, dispensing with the condenser, and produced portable engines very much smaller for their output than had been made hitherto. In 1801 his road carriage made its first trip and two years later his first rail locomotive ran on the Pen-y-daren tramway in South Wales.

Trevithick was born in 1771 and died in April, 1833. It has been decided to open a fund to commemorate next year the centenary of his death, and the leading engineering institutions have expressed their full sympathy with its objects. Messrs. Coutts and Co., 440, Strand, W.C.2, are acting as treasurers of the fund, and cheques should be made payable to them.

Electrical Water Sterilisation

Referring to the article bearing this title in our issue of December 23rd, Ozonair, Ltd., state that they have been making apparatus similar to that described for the last twenty-five years, and have supplied several plants for use abroad.

Empress Ballroom, Winter Gardens, Blackpool. (Inset the Tower control room)

Sound Amplifying at Blackpool

One of the largest band relay installations in this country has recently been carried out by the British Thomson-Houston Co., Ltd., to the order of the Blackpool Tower Co., Ltd., which controls the Tower, Winter Gardens, and the Palace, and by means of the equipment now installed music or speech may be relayed to the large ballrooms, cafés, lounges, the fairground, and circus in these buildings. There are seven amplifiers, giving a total undistorted output of 280 W; forty-four electro-dynamic loudspeakers; ten microphones; two twin turntable equipments for reproduction from gramophone records; and the necessary input and output control panels. Provision is made for the selection and relay of three dance bands, two cinema organs, orchestra, or gramophone records to any of the three buildings, which are connected by telephone lines. There are two main control rooms in which are the amplifiers, each giving 40 W undistorted output. The microphones are connected to the amplifiers through specially designed input control boards, which comprise switches for selecting and a transformer to step up the voltage of the 140-ohm microphone line for feeding the amplifiers, the inputs of which are connected in parallel. The individual outputs from the amplifiers are connected to control boards which consist of a number of horizontal copper bars, and vertical bars, to which the various loudspeakers are wired, are mounted behind the horizontal bars and insulated from them. Any two bars can be connected by means of plugs, and the volume in each hall adjusted. The permanent wiring was carried out by the Blackpool Tower Co.'s Works Department.

For Sale

Mr. Henry J. Shaw is to sell by auction on January 18th at 87a, Borough High Street, S.E.1, a quantity of radio and electrical apparatus, &c.

(See our classified advertisements to-day.)

New Catalogues and Lists

Feed Water Specialists Co., St. Paul's Square, Liverpool.—Technical publication No. 53 dealing with boiler explosions.

Electradix Radios, 218, Upper Thames Street, E.C.4.—A 74-page catalogue of radio and electrical apparatus and accessories. Also the "Electradix" sale list.

English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—Publications Nos. N.61 and K.81A dealing respectively with "Kosfi-Leading" motors and variable speed a.c. commutator motors.

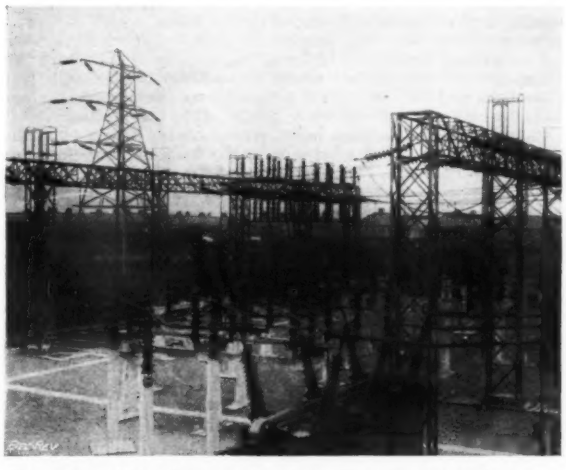
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, E.C.4.—Publication No. 1128 dealing with heating, ventilating and air conditioning.

Cinepro, Ltd., Sentinel House, Southampton Row, W.C.1.—Leaflets illustrating and describing Siemens & Halske cine cinemas and projectors for 16 mm. films.

British Insulated Cables, Ltd., Prescot, Lancs.—A 148-page illustrated catalogue (No. C.2.L.) of overhead line material for power, telegraph and telephone purposes. Also List No. P.270, relating to "B.I." radio materials.

Electrical Equipment & Carbon Co., Ltd., 107/111, New Oxford Street, W.C.1.—List No. H.D.2, giving full details of a new British-made slotted line tap.

Ferranti, Ltd., Hollinwood, Lancs.—List No. Wa550, giving



A section of the Central Electricity Board's sub-station at Brighton, which supplies part of the electricity required for the Southern Railway's new London-Brighton electrified line opened this week. This English Electric 132-kV station handles the entire supply for the Three Bridges-Brighton section of the line

the latest information regarding all types of "Ferranti" loudspeakers.

Revo Electric Co., Ltd., Britannia Works, Tividale, Tipton, Staffs.—A 67-page illustrated pocket book in a stiff leatherette cover, dealing with some of the most popular "Revo" specialities. Full details and prices are given.

Ozonair, Ltd., St. Leonard Street, S.W.1.—An illustrated leaflet issued by the Building Centre, describing "Ozonair" apparatus for ventilating purposes.

Electric Power Plant Co., Highurst Street, Nottingham.—A leaflet giving particulars of the "Safe Sign" visual signal for mines, &c.

Igranic Electric Co., Ltd., 149, Queen Victoria Street, E.C.4.—A list of addenda to the company's radio catalogue.

E. N. Bray, Ltd., Whipp's Cross Works, Wood Street, E.17.—A blotter illustrating the new 5/15-h.p., 200/500-V a.c. hand-operated stator/rotor starter.

Belling & Co., Bridge Works, Southbury Road, Enfield.—A coloured fire folder available for overprinting.

General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Leaflet No. W.6375, showing the complete G.E.C. range of flexible cords for motor-car lighting, ignition, and horns.

A.E.G. Electric Co., Ltd., 131, Victoria Street, S.W.1.—An illustrated leaflet on the "Elfa" small automatic circuit breaker.

Cuthbert Andrews, 47, Red Lion Street, W.C.1.—A booklet giving a full description of the "Protexray" X-ray tube.

Igranic Electric Co., Ltd., 149, Queen Victoria Street, E.C.4.—Publication No. 1011, dealing with across-the-line type automatic motor starters.

Synclocks, Ltd., 117, Victoria Street, S.W.1.—Sheet No. 610 describing "Synclock" synchronous motor driven time switches.

Erskine, Heap & Co., Ltd., Lancashire Switchgear Works, Caroline Street, Broughton, Manchester.—Pamphlet No. F.P.1, illustrating and describing the company's latest type of flameproof switchgear.

Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, W.C.2.—Leaflet Nos. 1102/3 and 1149 dealing respectively with type A.D.22 radio sets for small aeroplanes and type A.D.37a/38a sets for large aeroplanes.

Bankruptcy Proceedings

G. Howard (the younger), electrical engineer, 10, Alford Grove, Sprowston, Norfolk.—The first meeting of creditors was held recently at the Official Receiver's Office, 4, Eastbourne Place, Prince of Wales Road, Norwich. A statement of affairs was submitted which disclosed ranking liabilities of £100, with assets estimated to realise £42, leaving a deficiency of £59. The case being a summary one was left in the hands of the Official Receiver, as trustee.

The public examination will be held on January 10th at the Shirehall, Norwich.

J. R. Lister (trading as Roland Radio), 6, Watford Way, Hendon.—This debtor has lodged a statement of affairs at London Baukruptcy Buildings showing total liabilities of £808 (ranking £787) and assets of £78.

V. F. Maddox, electrical and wireless engineer, 6, Homend Street, Ledbury, Herefordshire.—The public examination was held recently at the Shirehall, Hereford, when a statement of affairs was submitted which disclosed gross liabilities of £240, of which £218 was expected to rank for dividend, and a deficiency of £147. The failure was attributed to bad trade, and debtor said that he was unaware of his position until the day before the receiving order was made. The examination was adjourned for closing.

H. C. Mealing (The Yorkshire and Lincolnshire Electric Development Co.), 73, Lawrence Street, York, and at Hull.—The public examination was held at the Law Courts, York, on December 22nd. The statement of affairs submitted showed gross liabilities of £916, and there were unsecured liabilities of £268, with a deficiency of £193. Debtor attributed his failure to "heavy overhead expenses which exceeded income." The examination was closed.

H. Fraser and **R. J. Ardern** (Ardern & Fraser), electrical appliance dealers, 29, Church Street, Accrington.—Trustee, Mr. J. Longthorn, 28, Queen Street, Great Harwood, appointed December 24th.

W. A. Beaumont, electrical engineer, 44, Warrengate, Wakefield.—Second supplemental dividend of 6s. 6d. in the £, payable December 30th at the Official Receiver's office, 13, Burton Street, Wakefield.

Company Liquidations

Perry & Co. (Overseas), Ltd.—Winding up voluntarily. Liquidator, Sir William H. Peat, 11, Ironmonger Lane, E.C.

Allerton Electrical Supplies, Ltd.—Particulars of claims by January 7th to the liquidator, Mr. H. A. G. Langton, 76, Merton Road, Bootle.

Read Radio (1931), Ltd.—Meeting January 24th at 5, Coleman Street, E.C., to receive an account of the winding up by the liquidator, Mr. P. E. Harding.

Dissolution of Partnership

Hille Bros., electrical engineers and radio dealers, 321, Queen's Road, Upton Park, E.—Messrs. C. Hille and R. Goldman have dissolved partnership. Mr. Goldman will attend to debts and carry on the business.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, Etc.	Price Jan. 4th.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... . per ton	£40	—
a Ammonia, Muriate (large crystal) ... „	£38	—
a Borax ... ... „	£17	—
a Copper, Sulphate ... ... „	£19 15s.	—
a Potash, Chlorate ... ... per lb.	3½d. to 4¼d.	—
a „ Perchlorate ... ... „	6d.	—
a Shellac T.N. ... ... per cwt.	£3	—
a Sulphur Commercial... ... ... per ton	£11	—
a „ Roll ... ... „	£11	—
a Soda Chlorate ... ... per lb.	3¼d. to 3¾d.	—
a „ Crystals... ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d.	—
METALS, Etc.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b „ Wire ... ... per lb.	1/1 to 1/9	—
b „ Sheet and Foil ... „	1/2 to 2/9	—
p Babbits Metal and Anti-fiction Metals—		
Grade I ... ... per ton net	£140	£1 dec.
Grade II ... ... „	£99	£1 dec.
Grade III ... ... „	£54	£1 dec.
c Brass (rolled metal 2" to 12" basis)... per lb.	7d.	—
c „ Tubes (solid drawn) ... ... „	8¾d. to 9d.	—
c „ Wire, basis ... ... „	7¾d.	—
c Copper Tubes (solid drawn)... ... „	9¼d.	—
g „ Bars (best selected)... ... per ton	£81	—
g „ Sheet... ... ... „		
g „ Rod ... ... „		
d „ (Electrolytic) Bars ... ... „	£36 5s.	—
d „ „ Sheets ... „	£84	—
d „ „ Wire Rods ... „	£41	£1 dec.
d „ „ H.C. Wire ... per lb.	6¼d.	¼d. inc.
f Ebonite Rod ... ... „	1/3 to 1/6	—
f „ Sheet ... ... „	1/3 to 1/6	—
n German Silver Wire ... ... „	2/2	—
k Gutta-percha, fine ... ... „	nom.	—
k India-rubber, Para fine ... ... „	4/9d.	—
i Iron, Pig (Cleveland No. 3)... ... perton	58 6	—
i „ Wire, galve. No. 1, P.O. qual. „	£20	—
g Lead, English pig ... ... „	£12 5s.	10s. dec.
g Mercury ... ... per bot.	£10 to £10 15s.	5s. to 7s. 6d. dec.
e Mica (in original cases) small ... per lb.	6d. to 3/6	—
e „ „ medium ... „	4/- to 8/-	—
e „ „ large ... „	8/6 to 17/6 & up	—
p Phosphor Bronze, plain castings ... „	1/1d.	—
p „ „ drawn bars & rods „	10¹d.	—
p „ „ rolled strip & sheet „	10¼d.	—
p „ „ wire ... ... „	11¼d.	—
o Platinum ... ... per oz.	£8 10s.	10s. dec.
d Silicium Bronze Wire ... ... per lb.	7⅝d.	⅛d. inc.
r Steel, magnet, in bars ... ... „	7¼d.	—
g Tin, Block (English)... ... ... per ton	£149 to £151	£1 10s. dec.
n „ Wire, Nos. 1 to 16 ... ... per lb.	3/1	—

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
k Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. F. Dennis & Co.

Electricity Supply

Lighting, Domestic, Power

Aberdeen.—SCHOOL LIGHTING.—The Education Committee is to substitute electricity for gas at the Kittybrewster and Mile End Schools.

MAINS EXTENSIONS.—The Electricity Committee has approved extensions of mains in twelve streets at a cost of £1,784.

STILL PROGRESSING.—Electricity generated by the Electricity Department in November amounted to 5,010,880 kWh, an increase of 518,480 kWh over the corresponding month last year.

Ashton-under-Lyne.—ASSISTED WIRING SCHEME.—In a report on a proposed assisted wiring scheme, Mr. N. Applebee, the borough engineer and manager, suggests that the scheme should apply to dwelling houses only or to houses and shops where the consumer lives on the premises, and that it should be restricted to premises already completed and not exceeding a rateable value of, say, £25. It is suggested that a penny per point per week would be an attractive figure to the consumer, and on this basis the scheme, which would be extended over a period of ten years, would easily pay its way. Mr. Applebee proposes that the work should be carried out by arrangement with local wiring contractors employing local labour as far as possible.

Aylesbury.—ASSISTED WIRING.—The Rural District Council has approached the Town Council for the installation of electric lighting on the hire system at sixty houses to be erected in the rural area. The matter has been left in the hands of the chairman of the Electricity Committee and the borough electrical engineer to make the best possible arrangements.

Bedford.—MAINS EXTENSIONS.—The Town Council has approved the following extensions of mains:—Rural demonstration scheme: Maulden, Green End, Aspley, Guise, Cranfield, Lidlington, Kempston Box End, Stagsden, Upper Shelton. Remainder of area: Kempston (Bedford Plough and Engineering Co., Ltd., and Bedford Road), Sandy, and Southill.

PUMPING PLANT.—The Council is to invite tenders for the supply and installation of an electrically driven pump at the waterworks undertaking.

Bingley.—ELECTRICITY PREFERRED.—A scheme prepared by the electrical engineer, Mr. O. G. Cook, for the lighting of Cottingley Moor Road, Sandy Lane and Lee Lane, has been accepted by the Urban District Council in preference to one presented by the Gas Department.

Birkenhead.—TRANSFER OF SUPPLY AREA.—Representatives of the Electricity Committee recently conferred with officials of the Hoylake and West Kirby Urban District Council as to the terms regarding the transfer to the latter, for the purposes of electricity supply, of certain parishes within the area comprised within the Wirral and Neston Electricity Special Order of 1925 which is to be added to the urban district. It was agreed to recommend the respective Councils to approve the transfer of rights and plant in the areas affected for the sum of £9,500. The Birkenhead Electricity Committee has agreed to receive a deputation from the Wirral Council with reference to lower electricity charges.

Bognor Regis.—ELECTRICITY FOR ANCTON.—An overhead l.p. line has now been completed and a supply given to the village of Ancton, just north of the New City.

Bolton.—MAINS AND PLANT.—The Electricity Committee has obtained sanction to the borrowing of £9,373 for mains and plant.

FRESH TENDERS.—The Housing Committee proposes to obtain fresh tenders for electrical installations at houses being erected on the Johnson Fold Estate.

Cannock.—EXTENSION OF SUPPLY AREA.—The Rural District Council has consented to the Urban District Council's extending its electricity supply area so as to include the village of Hazel Slade. The Rural Council expresses dissatisfaction with the rate at which the work of extending the supply in the area is being carried out by the Lichfield City Council, and intimates that the Council contemplates applying for a Fringe Order.

Chislehurst.—PROSPECTS OF CHEAPER ELECTRICITY.—The County of London Electric Supply Co., Ltd., which has acquired control of the Chislehurst Electric Supply Co., Ltd., has proposed to the Urban District Council the renewal of mains and reductions in charges subject to the Council's agreeing to an extension of tenure of the undertaking for a further period of forty-two years from 1940. A committee has been appointed to discuss the question with the company.

Clydebank.—ELECTRICITY FOR HOUSING SCHEME.—The Electricity Sub-committee of the Corporation is negotiating with the Clyde Valley Electrical Power Co. for the supply of electricity to the Napier Street housing scheme. The company is to lay all the necessary cables free and proposes, as an experiment, that the tenants should be charged a fixed weekly sum of 2s. for three-apartment and 2s. 6d. for four-apartment houses to cover the electricity supplied.

LARGER COOKERS WANTED.—Following complaints a larger type of cooker is to be installed on the Parkhall Housing Estate.

Coventry.—EXTENSIONS.—The Electricity Committee is to apply for sanction to a loan of £5,125 for extensions, and proposes to provide electricity supplies in the Pickford Green and Eastern Green areas.

Darlington.—A SPECIAL DISCOUNT.—The Electricity Committee recommends that a special discount of ten per cent. should be allowed on all charges for electricity consumed during the current quarter.

Durham.—SCHOOL LIGHTING.—The Board of Education has approved the installation of electric lighting in the following schools for the County Education Committee:—Chester-le-Street Secondary School, West Stanley Alderman Wood Secondary School and the Blaydon Secondary School.

Farlam (Cumberland).—PUBLIC LIGHTING.—The installation of lighting in the streets of Hallbankgate is under consideration and preliminary plans have been prepared for the work.

Forden.—LIGHTING OF INSTITUTION.—The Board of Guardians has asked the North Wales Power Co. for terms for lighting the Institution.

Galloway.—PROGRESS OF ELECTRICITY SCHEME.—The first section of the great tunnel in the Galloway Hills, which will be used to convey part of the Black Water of Dee to the Glenlee power station, was completed on December 27th, about five weeks ahead of schedule. This tunnel, which will eventually be 20,000 ft. long, will be one of the most important links in the Galloway hydro-electric scheme which is costing about £5,000,000. The section completed last week is about a mile long and extends from the first adit (or temporary entrance) to the portal, where the waters will emerge from the hills and fall through a pipe into the Ken Valley. Here the turbines of the 24,000-kW power station at Glenlee will be operated, the water then being passed on for use at two other power stations. The scheme is in the hands of Sir Alexander Gibb and Partners, the contractor for the Glenlee tunnel being Mr. A. M. Carmichael, of Edinburgh; Mr. W. Hudson is the resident engineer.

Godstone.—REDUCED CHARGES.—The Sevenoaks and District Electricity Co., Ltd., has reduced its charges for electricity for lighting from 8d. to 7½d. per kWh, and for business supplies from 7½d. to 7d. in the Sevenoaks and Godstone rural districts. The "unit" charge of the two-part tariff has also been lowered from 1½d. to 1¼d.

GRID SUPPLY WANTED.—The company is negotiating with the Central Electricity Board for a supply from the grid system either at East Grinstead or Horley.

Gower.—FIRST STAGE OF SCHEME COMPLETED.—The inauguration of the public electricity supply to Three Crosses on December 21st marked the completion of the first stage in the Rural District Council's scheme for the electrification of the whole peninsula. The scheme, which is being carried out by the South Wales Electrical Power Distribution Co., will take two years to complete and cost about £30,000.

Guildford.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains to supply the Wonersh-Cranleigh Road and Rowley Drive district at an estimated cost of £1,250.

SUPPLY IN COMPTON.—With reference to the decision of the Corporation not to offer any objection to the Mid-Southern Utility Co.'s supplying premises at Compton under a Fringe Order, the company has asked whether the Corporation would be willing to agree to the company's obtaining powers and to the rights of the Corporation being revoked in the northern part of Compton parish with the exception of that portion which is expected to be added to the borough. The Corporation has informed the company that it cannot agree to this request.

Harrogate.—WAYLEAVE INQUIRY.—A Ministry of Transport inquiry was held on December 21st into an application by the Corporation for compulsory wayleaves over parts of the Allerton Park Estate, in the parishes of Coneythorpe, Clareton and Flaxby. The Allerton & Rothwell Haigh Co. had refused consent to the Corporation's proposed cable route. The Corporation denied that the scheme would injure the amenities of the park. The objection was said to be largely concerned with the possible lopping of trees, which the Corporation undertook to take every precaution to avoid. There were, however, also objections on grounds that very few rural people desired the supply and then only if it were not expensive; that the scheme was not an economic proposition and would become a charge on the countryside; and that it was not necessary for the line to enter Lord Mowbray's property at all.

Holmbury St. Mary.—A REVISED SCHEME.—The Guildford Rural District Council has approved a revised scheme put forward by the London and Home Counties Joint Electricity Authority for the supply of electricity to Holmbury St. Mary. The whole of the l.p. mains are to be underground.

Ilford.—METER READINGS.—Meter readings are in future to be spread over the whole of the quarter.

Irish Free State.—GLENTIES SCHEME INAUGURATED.—The electricity scheme at Glenties, Co. Donegal, was inaugurated recently by Canon Forker. Electricity is generated by a crude-oil engine, which is believed to be the first of its type to be used in Ireland.

Irlam and Cadishead.—LOANS.—The Urban District Council has applied for sanction to a loan of an additional £36,010 for the electricity scheme.

STREET LIGHTING.—A Ministry of Health inspector is to hold an inquiry to-day at the Council Offices with regard to the Council's application for sanction to a loan of £3,000 for the substitution of electricity for gas for lighting Liverpool Road.

London.—STOKE NEWINGTON.—The Borough Council has received sanction to the borrowing of £17,673 for changing-over from d.c. to a.c. in the Green Lanes and Finsbury Park district.

Macclesfield.—CHEAPER ELECTRICITY.—The Electricity Co. of Macclesfield, Ltd., has decided to make the following reductions in its tariff provided that the Corporation does not proceed to arbitration in connection with the proposed acquisition of the undertaking:—Lighting, a reduction of ½d. per kWh; power, a reduction of 28½ per cent.; prepayment meter supplies, the rebate increased from 1d. to 2d. on each shilling; free wiring, a rebate of ½d. per kWh; late shop-window lighting reduced from 3d. to 1½d. per kWh.

Maidenhead.—TRANSFORMERS AND MAINS.—The Town Council has applied for sanction to a loan of £600 for transformers. Mains extensions and change-over work are to be carried out at an estimated cost of £1,713.

Menai Bridge.—EXTENSIONS PROPOSED.—Extensions to the electricity supply system in the island of Anglesey are contemplated. The North Wales Power Co. has written to the local council pointing out that the question of a bulk supply is bound up with this proposal and it would be in the interests of the Council to defer any action it contemplates taking until arrangements have been made for the extension of the transmission line from Llanfair P.G. towards Beaumaris.

North Kesteven.—OVERHEAD LINES SANCTIONED.—The Rural District Council has given its consent to the Mid-Lincolnshire Electric Supply Co., Ltd., placing overhead lines for the supply of electricity between the parishes of Bracebridge Heath, Waddington, and Harmston.

Oldham.—EXTENSIONS.—Application is to be made by the Town Council for sanction to a loan of £120,000 for electrical extensions.

Reigate.—ACQUISITION OF UNDERTAKING.—The Rural District Council and other interested public bodies within the area of the County of London Electric Supply Co., Ltd., have decided to raise no objection to the proposed acquisition of the undertaking of the Urban Electric Supply Co., Ltd., by the London and Home Counties Joint Electricity Authority provided that the terms for the supply of electricity in Chaldon are as favourable as those which would obtain if the undertaking was acquired by the County of London Co.

Rugby.—DAYTIME SHOP LIGHTING.—The Town Council has adopted an alternative tariff for daytime lighting by tradesmen with a fixed charge of £10 per annum per kW of lighting installed, plus ¾d. per kWh consumed.

St. Helens.—EXTENSIONS.—The Town Council has applied for sanction to a loan of £4,670 for extensions in Rainford, Burtonwood and Bold.

St. Michaels-on-Wyre.—SUPPLY INAUGURATED.—The electricity scheme for the district was recently inaugurated by Lord Derby and already about 75 per cent. of the townspeople are taking supplies. The scheme forms part of a larger one embracing Elswick and Garstang and costing £23,000. Preston Corporation has already spent £127,000 on the electrification of neighbouring districts.

Salford.—MAINS AND SERVICES.—The Electricity Committee is to apply for sanction to a loan of £300,000 for mains and services in Salford and Prestwich.

Southend-on-Sea.—BULK SUPPLY TO SHOEBURYNESS.—The Town Council has received sanction to a loan of £11,378 in connection with the bulk supply to Shoeburyness.

LOANS.—Sanction is being sought to loans of £228, excess expenditure on the laying of the new 3,000-V a.c. supply main on the pier, £1,383 for a transformer station and switchgear at Canterbury Avenue, and £20,000 for mains.

REDUCED CHARGES.—The Town Council has adopted the following reduced scale of charges involving a concession of £10,240 to consumers:—All-in domestic tariff, a fixed charge of 10 per cent. of the rateable value up to £50 and 5 per cent. on the portion above £50, plus ¾d. per kWh in the winter and ½d. in the summer; the use of a domestic cooker or water heater entitles the consumer to the alternative "unit" charge of ¾d. throughout the year. Water heating, ½d. per kWh. Lighting, 5d.; heating, 1½d. All-in business tariff for lighting and heating, a reduction in the fixed charge, with a discount of 5 per cent. on fixed and "unit" charges. Industrial heating and cooking, from ¾d. to ½d. per kWh. Power, first 1,000 kWh per quarter, 3d. per kWh, beyond 1½d.

South Shields.—STREET LIGHTING.—A committee has been elected to go into the matter of converting street lamps from gas to electricity.

The Nelson and Scottish National Monuments at Calton Hill, Edinburgh, present a very imposing spectacle when floodlighted

ELECTRICITY FOR INSTITUTION.—The provision of an electricity supply for the Harton Poor Law Institution is being considered.

Stockton-on-Tees.—SCHOOL LIGHTING.—The Corporation has decided to substitute electric lighting for gas in the Stockton secondary schools.

Stoke-on-Trent.—MAINS AND EXTENSIONS.—The Electricity Committee is to extend the mains to supply premises at Meir at a cost of about £300.

Stone (Staffs).—SUPPLY TO WALTON.—The Urban District Council is to extend the electricity supply to Walton.

Tamworth.—EXTENSION OF COMPANY'S SUPPLY POWERS.—The Town Council has agreed to the Tamworth District Electricity Supply Co., Ltd., continuing to operate the town's electricity undertaking until October 1st, 1939. The adoption of a two-part tariff is to be optional.

Taunton.—LOANS.—The Town Council has applied for sanction to loans of £20,000 for mains and services, and £10,000 for transformers, sub-stations and equipment.

Towyn (Merioneth).—WIRING SCHEME.—The Urban District Council is canvassing householders with a view to instituting a wiring scheme costing £8,000.

Winchester.—OVERHEAD LINES.—The Mid-Southern Utility Co. has informed the Rural District Council that it proposes to erect l.p. overhead lines in Alresford and the neighbourhood.

Wingate (Co. Durham).—STREET LIGHTING.—The Parish Council has reached a provisional agreement with the Weardale, Wingate and Trimdon Coal Co., for supplying electricity at 2d. per kWh for ten years for the street lighting of Wingate, Wheatley Hill, and Deaf Hill.

Wood Green.—TRANSFER OF UNDERTAKING.—As from the commencement of the New Year, the North Metropolitan Electric Power Supply Co. has taken over from the Tottenham and District Gas Co. the electricity undertaking under the Wood Green Electric Lighting Order. Over 5,000 consumers are affected by the change.

York.—MAINS.—The Electricity Committee has obtained sanction to the borrowing of £4,100 for mains.

Municipal Supply Undertakings' Results

District.	Engineer.	Revenue. 1931.	Revenue. 1932.	Working Expenditure. 1931.	Working Expenditure. 1932.	Profit (+) or Loss (−) 1931.	Profit (+) or Loss (−) 1932.	Sales of Electricity. 1931.	Sales of Electricity. 1932.
		£	£	£	£	£	£	kWh.	kWh.
Ashford	H. Wilson	32,229	38,146	17,972	20,214	+ 4,041	+ 6,617	4,702,013	5,510,939
Ayrshire	W. C. Bexon	250,227	277,574	110,100	113,189	+ 236	+ 2,544	42,130,942	45,882,284
Aylesbury	W. A. Turnbull	19,029	74,846	37,012	39,607	—	+ 8,396	7,927,485	8,687,232
Bexhill	C. A. Frost	43,488	45,071	33,053	33,716	− 231	+ 440	5,105,649	5,344,463
Bradford	T. Roles	619,198	623,856	378,617	359,569	+ 28,919	+ 29,694	92,995,037	99,671,585
Bury	J. G. Potts	115,897	114,204	109,050	98,871	+ 1,758	+ 7,525	26,030,482	24,410,104
Erith	J. C. Williams	—	69,027	—	45,198	—	+ 17,534		16,718,380
Gillingham	H. Hall	56,143	64,296	34,292	40,722	+ 13,577	+ 13,290	7,564,434	9,726,003
Hackney	L. L. Robinson	290,214	320,632	141,420	150,518	+ 236	+ 2,544	42,130,942	45,273,246
Harrogate	N. M'Lean	85,017	91,054	35,729	37,612	+ 16,121	+ 17,143	9,870,143	11,210,725
Hove	F. Swarbrick	83,476	91,530	53,163	51,455	− 652	+ 7,502	8,480,236	9,179,574
Newark	R. E. Livesley	17,224	18,135	11,143	11,612	+ 2,846	+ 2,979	—	—
South Shields	J. Edgar	112,807	110,108	53,913	54,961	+ 6,811	+ 789	11,332,982	10,761,812
Southend	A. C. Johnson	227,120	234,353	125,607	121,150	+ 53,139	+ 78,272	18,990,109	20,618,914
Stepney	W. C. P. Tapper	389,201	408,984	192,656	194,307	+ 12,819	+ 7,245	77,711,778	77,137,016
Walton-on-Thames	E. H. Anderson	—	7,306	—	21,977	—	+ 5,658	3,097,005	2,903,469
Wick	W. Conrad Roy	3,947	6,250	—	—	+ 198	+ 591	172,214	285,673
Winchester	R. Ayton	39,870	50,552	21,016	33,964	+ 3,418	+ 556	2,747,017	2,886,641

Traction

Austria.—A NEW ELECTRIC LOCOMOTIVE.—A new type of electric locomotive has recently been put into service on the Austrian State Railways. It carries a transformer which takes a.c. from an overhead 15,000-V line. The transformer has two entirely separate secondary windings, each of which feeds power at 624 V to the windings of a convertor. The latter supplies three-phase power which is converted by two frequency changers to d.c. by which the traction motors are operated. The convertor set is started up by a single-phase collector-type motor, which afterwards serves as a d.c. exciter supplying the necessary power for the convertor. The locomotive, which weighs 118 tons, of which the electrical equipment is responsible for 59 tons, is able to attain a speed of 37½ m.p.h.

Belgium.—BRUSSELS-ANTWERP RAILWAY ELECTRIFICATION.—The directors of the Belgian National Railways Co. are to meet this month to come to a decision regarding the proposal to electrify the railway between Brussels and Antwerp. The cost of the scheme is estimated at 100,000,000 francs.

Bolton.—TRACK RECONSTRUCTION.—The Tramways Committee is to reconstruct the tram track in Chorley New Road.

Derby.—PREVENTING RADIO INTERFERENCE.—The Town Council is to consider a proposal to equip all trolley-buses with apparatus for preventing radio interference at a cost of £20 per vehicle.

Dunfermline.—TRAFFIC CONTROL.—The Corporation is to install traffic control signals costing £870 at several street junctions.

France.—LOCOMOTIVE ORDER PLACED.—The Southern Railway of France is reported to have placed an order with the "Alsthom" concern for the delivery of forty-seven electric locomotives. Transformer stations will also be established partly by the Alsthom and the Compagnie Electro-Mécanique.

PARIS TRAMS TO GO.—According to an *Exchange Telegraph* message, the Paris trams are doomed. The General Council of the Seine is to issue a loan of 53,000,000 francs (£424,000 at par) for their replacement by 303 motor-buses.

Germany.—RAILWAY ELECTRIFICATION.—With the completion of the electrification of the section of line between Hirschberg and Landeshut last month, the total length of electrified railway in Schlesien now amounts to 293 km.—*Electrotechnische Zeitschrift.*

Italy.—RAILWAY ELECTRIFICATION.—The Italian Ministry of Communications has authorised a start to be made on a scheme for the electrification within twelve years of a further 4,365 km. of railway at a total cost of 4,200,000,000 lire (£45,400,000 at par), says a *Reuter's Trade Service* message from Rome. The scheme is divided into three sections, each covering four years' work. Generally speaking, the lines so far electrified are in the north and centre of Italy, the most important being that from Leghorn to Genoa, Turin and Modane. The plan also provides for the electrification of the main line from Milan to Reggio di Calabria on the Straits of Messina and the Turin-Trieste line. The railways joining Italy to Switzerland and Austria will also be electrified. A series of big hydro-electric power stations will be built; several are already under construction.

London.—A SPEED-UP ON THE PICCADILLY LINE.—Next week it will be possible to travel between Northfields and Piccadilly Circus in 22½ minutes, the improved running time being made possible by the use of additional tracks between Northfields and Acton Town which permit a through service.

Norwich.—OPPOSITION TO PURCHASE OF TRAMS.—At a Common Hall (a meeting of electors), a resolution to approve the action of the City Council to promote a Bill authorising the acquisition and operation of the undertaking of the Norwich Electric Tramways Co. at a purchase price of £175,000 was rejected by 314 votes to 275.

Reading.—TRAMWAY ABANDONMENT.—The Minister of Transport has sanctioned the abandonment of the tramways in London Street, London Road, Craven Road and Erleigh Road.

Southern Railway.—FURTHER ELECTRIFICATION PROPOSED.—Following the opening of the new electrified main line service between London and Brighton and Worthing at the beginning of the week, the *Morning Post* understands that operations will begin shortly on the further extension of the electrification to Eastbourne and Hastings. No estimate of the cost of the new scheme is yet available, but the work would probably take between six months and a year to complete. The extension would probably be carried first through Wivelsfield to Eastbourne, with the electrification of the direct line to Hastings *via* Tunbridge Wells following.

South Shields.—TRACK EXTENSIONS.—The Town Improvement and Watch Committees have agreed not to oppose a proposal of the Tramways Committee to extend the tram track in Prince Edward Road.

TRANSPORT ECONOMY SCHEME ADOPTED.—After a long discussion the Town Council has adopted the economy measures set out by Mr. J. Austin Baker, manager of the transport undertaking (ELEC. REV., December 9th, p. 868), in order to prevent a deficit of £5,000 on the undertaking for the year ending March 31st next.

Communications

Australia.—WIRELESS LICENCES.—For thirteen months in succession up to the end of October the number of radio receiving licences in force in Australia has shown a good increase. The total number in that period has increased by 70,891, or 22 per cent. At October 31st the total number in force in the Commonwealth was 317,490.

Ceylon.—TELEGRAPH AND TELEPHONE SYSTEMS.—Our Indian correspondent reports that in connection with the proposal that Imperial and International Communications, Ltd., should take over the Ceylon telephone and telegraph system, Sir William Barton, who recently visited Colombo, has pointed out that the Ceylon system on its present working showed an annual deficit of Rs.500,000 on telephones and Rs.1,000,000 on telegraphs, and if the proposal materialised a local company would be formed, with Ceylonese directors on the board. The Government would receive a royalty on gross profits, which would increase as the business expanded. The automatic telephone would be installed at once and there would be a link with the beam wireless telephone system to London *via* Bombay. If the Government, after ten years or so, wished to resume the telegraph and telephone services, it would be open for it to do so on reasonable terms. It is understood that the Postmaster-General of Ceylon is to submit a report on the matter shortly.

Great Britain.—CHIEF BROADCASTING EVENTS IN 1932.—In a review of its work during 1932, the B.B.C. states that the total transmission hours for all stations was 58,163, and the average breakdown time was 0.023 per cent., against that of the previous year, which was 0.03 per cent. The three outstanding events of the past year were the completion of Broadcasting House, the Scottish regional station at Westerglen, near Falkirk, and the Empire station at Daventry. The design of the control room in Broadcasting House was carried out entirely by B.B.C. engineers and there is no exact counterpart of this room in the world. Other engineering activities included the replacement of a good deal of the apparatus used at provincial stations and the provision of up-to-date studios. Useful work was accomplished in the suppression of interference from electrical apparatus in co-operation with the General Post Office. Over 450 new schools secured apparatus during the year, and the Central Council for School Broadcasting has prepared, for the guidance of local education authorities and schools, a list of apparatus which has been demonstrated under class-room conditions to a sub-committee of the Council and passed as suitable for use in schools.

From August 22nd television programmes were broadcast on Mondays, Tuesdays, Wednesdays, and Fridays of each week from 11 to 11.30 p.m., sound being transmitted on 398.9 and vision on 261.3 metres.

RADIO RELAY EXCHANGES.—The Clitheroe Rural Council has received an application from a firm at Keighley for permission to establish a relay service at Whalley. The Lancs County Council, which is the licensing authority, has asked if it is desirable or necessary to issue another licence when one has already been granted to a Burnley firm, which has established a service at Chatburn. The Rural Council has decided to ascertain whether the first licence covers the whole of the rural area.

The Godmanchester Town Council is considering an application for permission to establish a service for the town.

The Teddington Town Council has again refused permission to establish a service, as has also the Windsor Town Council.

India.—CARRIER TELEPHONY.—With the completion of the radio-telegraph link between India and Japan as well as the radio-telephone link between India and England, the Indian Radio and Cable Communications Company is now endeavouring to arrange a sufficient number of communication channels between its control office at Bombay and the radio transmitters and receivers in Kirlee and Dhond, respectively. The difficulties and high costs of building and maintaining a sufficient number of overhead lines through the jungle between these places has persuaded the company to try carrier circuits on one of the two existing telephone pairs, with the other pair as a spare in case of line faults. The equipment has been ordered from the Ericsson Co. and it will be the first multi-channel installation in India with both telephone and telegraph carrier channels on the same pair.

London.—A NEW TELEPHONE FACILITY.—As we briefly reported in our last issue, a private concern has just been licensed by the Postmaster-General to open, in London and the provinces, repositories for telephone calls. This is to enable a subscriber to receive calls which come through when he is away from his telephone. The London branch of this concern, equipped with thirty-five exchange telephone lines, is at Grosvenor Place, and will commence operating on January 9th. When a subscriber joins the service his business connections are notified that if they can get no answer from his number they can, at any hour of the day or night, leave a message at this new exchange. If it is after the subscriber's business hours the message will be delivered the following day, or, if urgent, passed on to his private address. Travellers on the road will be able to deliver and receive calls through this central service. A booklet containing the full details of the service, together with a scale of charges, has been sent us by Cetex, Ltd., 19, Grosvenor Place, S.W.1, the company which is responsible for the service.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Army Contracts.—Firms not already on the War Office list of tenderers, and who wish to be invited to tender for Army requirements for various electrical and other equipment, should apply to the Director of Army Contracts, Caxton House (West), Tothill Street, S.W.1. (See this issue.)

Ashford.—January 16th. Electricity Department. 33-kV transmission line. (December 23rd.)

Barnes.—February 6th. Corporation. Traffic control signals. (See this issue.)

Cardiff.—January 12th. Public Health Department. Radio receiving and amplifying equipment for Llandough Hospital. (See this issue.)

Dundee.—January 11th. Electricity Department. Cables. (December 30th.)

January 12th. Various works required in the construction of a static sub-station. Mr. D. H. Bishop, general manager.

Egypt.—CAIRO.—February 7th. Ministry of the Interior. Power station of about 660-kVA capacity. (A.X. 11589.)*

SUEZ.—January 21st. Suez Local Commission. Underground armoured cables. (A.X. 11640.)*

Elie and Earlsferry (Fife).—January 23rd. Corporation. Various works (including electrical) at housing scheme. Mr. M. A. D. Haxton, architect, Commercial Road, Leven.

Galloway.—January 12th. Galloway Water Power Co. Construction of Glenlee power station (foundations and steelwork). Sir Alexander Gibb & Partners, Queen Anne's Lodge, Westminster, S.W.1 (fee of £10 10s.).

Halifax.—January 7th. Improvements Committee. Electricians' work for King Cross development. Mr. D. T. Lloyd Jones, borough engineer, Crossley Street (deposit £2 2s.).

Hull.—January 17th. Electricity Department. Two 200-Ah stationary batteries, charging equipment, switchgear, &c. (December 23rd.)

January 17th. Electricity Department. General stores. (See this issue.)

Irish Free State.—DRUMKEERAN (Co. LEITRIM).—January 9th. Electricity Supply Co. Erection of overhead network and electric lighting and power plant. Mr. M. E. Fitzgerald, consulting engineer, 2, Upper Ely Place, Dublin (deposit £5).

Isle of Man.—January 23rd. Electricity Board. 33-kV transformers. (See this issue.)

Liverpool.—February 1st. Electricity Department. General stores. (See this issue.)

London.—ISLINGTON.—January 20th. Electricity Department. Electrical and engineers' stores. (December 16th.)

New Zealand.—WELLINGTON.—February 7th. Post and Telegraph Department. 800 bell receivers and 5,000 mouthpieces. (A.X. 11627.)* 600 keys and 200 lamp caps. (A. 11626.)*

February 15th. Cord adjusters for telephone switchboards. (A. 11650.)*

March 7th. Public Works Department. 21,300 yds. of v.i.r. cables for Waitaki. (A.X. 11651.)*

Northern Ireland.—BELFAST.—January 27th Electricity Department. General stores. (See this issue.)

South Africa.—CAPETOWN.—January 18th. Electricity Department. Refrigerating plant for municipal abattoir, Maitland. (A.X. 11637.)*

JOHANNESBURG.—January 28th. City Council. Metal-clad l.p. switchgear. (A.X. 11647.)*

PORT ELIZABETH.—January 26th. City Council. Cables, transformers, motors, and switchgear. (A.X. 11646.)*

Swansea.—January 19th. Electricity Department. Condensing plant for Tir John North power station. (December 16th.)

Thorne.—January 10th. West Riding County Council. Installation of electric lighting at additions to Boys' Council School. Education officer, County Hall, Wakefield.

Torquay.—January 14th. Electricity Department. 11-kV overhead and underground transmission line. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Birmingham.—City Council. Accepted. Power and electrical charging equipment at Montague Street refuse disposal works (£11,078).—United Electrical Co. The tender includes engine plant by Belliss & Morcom, Ltd., and electrical plant by the General Electric Co., Ltd.

Blackburn.—Town Council. Accepted. Traffic signals.—Automatic Electric Co., Ltd.; **Forest City Electric Co.**

Bolton.—Electricity Committee. Accepted. Switchgear alterations and additional switchgear for connecting up the generating station to the main transmission lines of the Central Electricity Board.—Metropolitan-Vickers Electrical Co., Ltd.

Dartford.—Electricity Committee. Accepted. Wiring houses under assisted wiring scheme for six months at £2 11s. 6d. for four-light points; 12s. 9d. for extra light points, and 12s. 9d. for plug points.—Dartford Electrical Co.

Derby.—Electricity Committee. Accepted. Oil circuit breakers and control apparatus (£1,768).—British Thomson-Houston Co., Ltd.

Eastbourne.—Electricity Committee. Accepted. 11,000-V 300-kVA transformer for Meachants sub-station (£179).—British Electric Transformer Co., Ltd.

East Lothian.—County Council. Installation of electrical fittings at new school, Prestonpans (£3,554).—W. A. Smith & Co.

Heywood and Middleton.—Water Board. Accepted. Electric lighting at the mechanical filter house in Clay Lane.—C. Rhodes.

Gillingham.—Electricity Committee. Recommended. Switchgear (£747).—A. Reyrolle & Co., Ltd.

Hull.—Telephones Committee. Recommended. Lead-covered cable (£514).—W. F. Dennis & Co. Loading coils (£80).—Automatic Electric Co., Ltd. Inside wire (£77).—W. T. Henley's Telegraph Works Co., Ltd.

Ilford.—Electricity Committee. Recommended. Four transformers (£179).—British Electric Transformer Co., Ltd.

Leeds.—Finance Committee. Accepted. Installation of telephones at Civic Hall (£2,246).—Standard Telephones & Cables, Ltd.

Tramways Committee. Accepted. One set of tramcar electrical equipment (£450).—Crompton Parkinson, Ltd. Trolley wire (£279).—Richard Johnson & Nephew, Ltd.

Electricity Committee. Accepted. Cables.—W. T. Henley's Telegraph Works Co., Ltd. (£300); Macintosh Cable Co., Ltd. (£242); Edison Swan Cables, Ltd. (£565).

Sewerage Committee. Accepted. Electric lighting installation at Knostrop works (£155).—C. D. Denham & Co.

Preston.—Town Council. Accepted. Private automatic branch telephone exchange at the new municipal buildings (£1,417).—Standard Telephones and Cables, Ltd.

Sittingbourne and Milton Regis.—Urban District Council. Accepted. Work in connection with the drainage scheme:—Electrical cables (£1,590), and electric lighting, telephone, and signalling apparatus (£300).—Burdette & Co., Ltd. Pumping plant (£2,331).—Wallwin (Pumps), Ltd.

Southend-on-Sea.—Town Council. Accepted. H.p. cables—Pirelli-General Cable Works, Ltd. L.p. cables.—Derby Cables, Ltd. Conversion of consumers' apparatus from d.c. to a.c. in the Marine Parade area (£623), and at the Kursaal (£1,094).—W. Jay. Similar work at the Kursaal (£1,471).—F. P. Richard & Co. Water heaters.—Electric Fires, Ltd.; and Santon, Ltd. Cooking apparatus. G.E.C.; Jackson Electric Stove Co., Ltd. Wash boilers.—Santon, Ltd.; and Jackson Electric Stove Co., Ltd.

Wakefield.—Health Committee. Accepted. Electrical work at new maternity hospital, Manygates Park (£1,338).—Walter Robb, Ltd.

Forthcoming Events

Institution of Electrical Engineers.—Monday, January 9th. Institution, London. 7 p.m. Informal meeting. Discussion on "Television." Opened by Mr. H. J. B. Chapple. (*Meter and Instrument Section*).—Friday, January 6th. 7 p.m. Synthetic Corundum for Jewel Bearings. Mr. E. G. Sandmeier. (*Mersey and North Wales (Liverpool) Centre*).—Monday, January 9th. University, Liverpool. 7 p.m. "Broadcasting." Mr. N. Ashbridge. (*North-Eastern Centre*).—Monday, January 9th. Carliol House, Newcastle-upon-Tyne. 6 p.m. "The Economic Problems of the Swedish State Railway Electrification." Mr. I. Ofverholm. (*Western Centre*).—Monday, January 9th. Berkeley Café, Bristol. 6.30 for 7 p.m. Annual dinner. (*North Midland Centre*).—Tuesday, January 10th. Hotel Metropole, Leeds. 7 p.m. "The Inland Telegraph Service—The Introduction of Modern Machinery and Methods." Mr. R. P. Smith. (*North-Western Centre*).—Tuesday, January 10th. College of Technology, Manchester. Joint meeting with the Manchester Association of Engineers. Mr. Ofverholm's paper. (*Scottish Centre*).—Tuesday, January 10th. Elmbank Crescent, Glasgow. 7.30 p.m. "Distant Indication." Messrs. C. Midworth and G. F. Tagg. (*South Midland Students' Section*).—Tuesday, January 10th. University, Birmingham. 7 p.m. Address by Mr. J. Morton, senior section chairman. (*Hampshire Sub-Centre*).—Wednesday, January 11th. Municipal College, Portsmouth. 7.30 p.m. "The Propagation of Short Waves." Mr. T. L. Eckersley. (*Dundee Sub-Centre*).—Thursday, January 12th. University College, Dundee. 7.30 p.m. "An Application of an Eddy-Current Drag." Mr. J. Hargrove. (*London Students' Section*).—Friday, January 13th. Institution, London. 6.15 p.m. "The Problem of the Single-Line Railway. Mr. A. Weir. (*North-Eastern Students' Section*).—Friday, January 13th. Armstrong College, Newcastle-upon-Tyne. 7.15 p.m. "The Utility of Patents." Mr. I. J. St. A. Crawshaw.

Electrical Development Association (Northern Counties Area).—Friday, January 13th. Oxford Galleries, Newcastle-upon-Tyne. Electrical carnival.

Electrical Power Engineers' Association (*London Technical Group*).—Tuesday, January 10th. Junior Institution of Engineers, London. 7.15 p.m. "Electric Arc Welding." Mr. E. P. S. Gardner.

Junior Institution of Engineers.—Friday, December 13th. Institution, London. 7.30 p.m. "Some Practical Notes on Vibration." Mr. J. Calderwood.

Television Society.—Wednesday, January 11th. University College, W.C. 7 p.m. "A New Television System." Mr. E. H. Traub.

Our Service Department

Inquiries must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of the makers of the following:—

A self-generating torch operated by an up-and-down motion (not the usual lever-driven type).

Neon transformers with adjustable chokes marked "Prov. Patent 13937/31."

EROS flashing lampholder or flashing lampholder adaptor.

TONGUE ammeter.

Notes

New Parliamentary Bills

We publish below a list of proposals of an electrical nature that will come forward in the ensuing session of Parliament. Readers who are desirous of obtaining further information will find the notices published in the *London Gazette* for December 6th and 9th.

Wimbledon, Barking, Bridlington, Dewsbury, St. Helens and Worksop Corporations, and Plympton St. Mary R.D.C.—Further powers in relation to the respective electricity undertakings.

Colne Corporation.—Further powers with regard to the electricity undertaking; further provisions in respect of the transport services in the borough and elsewhere.

Torquay Tramways Co., Ltd.—Abandonment of the existing tramways and the provision of trolley vehicles, and for other purposes.

National Electric Construction Co.—Abandonment of the tramways in the boroughs of Dewsbury and Osset, and provision for the running of public service vehicles in substitution therefor.

Bootle Corporation.—Powers with regard to the running of public vehicles in the borough and neighbourhood and provision for the abandonment of the tramways in the borough; and for other purposes.

Manchester Corporation.—Provision for trolley vehicles.

York Corporation.—Authority to transfer the light railway, trolley vehicle and public service vehicle undertakings to a company to be formed; abandonment of the light railways and trolley vehicle routes.

Yorkshire Traction Co., Ltd.—Abandonment of the railways constructed under the Dearne District Light Railways Orders, 1915 and 1924, and the running of stage carriages in substitution therefor.

The Highfield Shield Competition

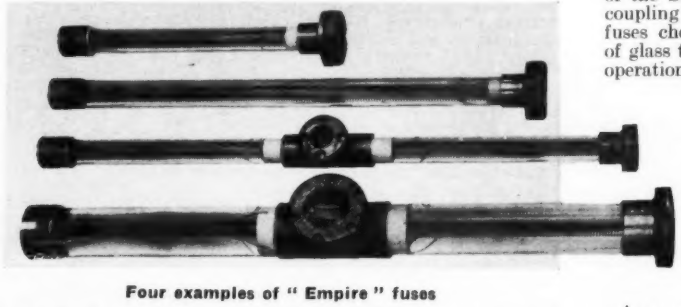
Full particulars of the tenth annual W. E. Highfield Shield Competition for papers submitted in 1933 by supervising engineers, foremen, and associates are obtainable from the Association of Supervising Electrical Engineers, Chalmers House, 43, Russell Square, W.C.1. Donations for additional cash prizes have been made by Sir William Noble, Callender's Cable & Construction Co., Ltd., and the General Electric Co., Ltd.

The E.A.W.

The staff of the Electrical Association for Women has now moved into the new premises at 20, Regent Street, London, S.W.1, which members will have an opportunity of inspecting at the end of the month. Early in February the Duchess of York is expected to visit the new Electrical Housecraft School, which is being equipped with modern electrical domestic appliances; the kitchen has been planned on fatigue-saving lines, and its lighting is receiving special attention. The illumination of the new clubroom will be of a decorative nature, and a new feature of the headquarters will be a library of English, European, and American books on electrical housecraft and scientific home management.

Standard Galvanising Tests

The British Standards Institution announces that B.S.S. 443-1932, which defines the testing of the zinc coating on galvanised wires, has now superseded all galvanising tests prescribed in the twelve Standard Specifications issued between 1924 and 1930 relative to overhead aluminium power conductors, steel wires used for communication circuits, and steel ropes.



Four examples of " Empire " fuses

A Copper Wire Specification

Recent improvements in the manufacture of enamelled high-conductivity annealed copper wire are reflected in a new British Standard Specification (No. 156-1932). It has, for instance, been found possible to make the requirements regarding freedom from pinholes much more stringent than in the old specification. In addition, the maximum permissible overall diameters of the enamelled wires have been slightly reduced, without any reduction in the severity of the high-voltage test. No minimum overall diameter is specified, since from the users' point of view the thinner the enamel the better, provided the wire passes the electrical tests.

All the tests given in the original specification have been retained, and a clause covering joints has been added. The methods now adopted of carrying out the mechanical tests simulate more closely practical conditions and, although the diameters of the mandrels on which the wires are wound a greater, the present test is more satisfactory than the old tes It has not been found practicable to dispense with the " roug and ready " thumbnail test which is found so useful by a experienced person. An improved form of test for inflan mability of enamel has been substituted for the original tes

The nominal sizes of copper wire adopted conform wi those in B.S.S. No. 128, the enamelled wire specification cove ing the primary and secondary sizes in that specification fro 0.002 in. up to 0.128 in. diameter. In view of the liability the wire to become stretched slightly during the process enamelling, it is necessary to allow greater tolerance on th resistance of enamelled wire than on plain copper wire. Th aspect of the problem has been considered in the course of th revision of B.S.S. No. 156, and a more rational series of tole ances on resistance has been adopted in the present specific tion, the values of tolerance now adopted for the sizes of wi from 0.01 in. up to 0.048 in. (the maximum size in the ol specification) being appreciably less. The method of expressin the tolerance is more convenient in the revised specification.

Copies of this specification are obtainable from the Britis Standards Institution, 28, Victoria Street, S.W.1, price 2s. 2 post free.

The " Arsenal's " New Stand

Electricity is put to good account in the luxurious ne stand at the Arsenal football ground at Highbury. " Unity tubular heaters supplied by Messrs. Barker, Young & Co Ltd., are used for the main heating in the directors' reception and smoking room, the corridors, and the lounge. In th directors' rooms this heating is supplemented by " Tricity Sunray " lamps; there is a special central lighting fittin and eight wall brackets which were designed by Mr. Claude V Ferrier, the architect, and made by Messrs. Hailwood Ackroyd. The reception room lighting is arranged in t same way as that for the smoking room; the lounge lightin fittings are of Hailwood & Ackroyd standard type, speciall finished in the Arsenal colours, scarlet and white. There ar 350ft. of heating tube and 260 lighting points throughout " J. & P." wiring is employed, with Walsall tubing an switches. " Synchronome " electric clocks complete the elec trical installation which was carried out by Messrs. T. Clark & Co., Ltd. Illustrations appear on page 13.

An Outsize in Clocks

The new clock just erected on Grand Buildings, Trafalga Square, London (see page 15), has a rectangular dial 33 ft by 27 ft. and is claimed to be the largest in the country. Six hundred feet of red, blue and yellow neon tubing are used t illuminate the hands, figures, and wording. The manufac turers of the clock, which is driven by a Smith's synchronou motor, were Messrs. Gillett & Johnston, Ltd., the electrica contractors being Ionlite, Ltd.

Appointments Vacant

Deputy borough electrical engineer for Eastbourne Elec tricity Department. (See our classified advertisements to-day.)

132-kV Fuse Tests

The necessity for an economical method of tapping the 132-kV lines of the grid led Mr. J. M. Kennedy, of Messrs. Kennedy and Donkin, to make arrangements with the Central Electricity Board for a series of tests on high rupturing capacity fuses. The first tests were made at the Kirkcaldy sub-station of the Scottish grid, where sufficient power was available by coupling up all or any of the power stations in Scotland. The fuses chosen were the chemical extinguisher type consisting of glass tubes of suitable length with metal ferrules and spring operation to ensure sufficient gap in the extinguishing liquid after the fuse had blown. Those tested were " Empire " brand fuses of Electric Control manufacture of American design.

Tests were begun with short circuits of about 85,000 kVA and carried up to 170,000 kVA. The fuses cleared short circuits up to 142,000 kVA but failed to clear two short circuits of 120,000 kVA; in every test the glass tubes were broken. At 170,000 kVA the fuses failed to clear and the short circuit was cleared by the oil circuit breaker. The fuses which cleared successfully opened within 4 to 8 cycles.

As a result of this experience new fuses of a minimum capacity of 1,000,000 kVA were designed, on which a further series of tests was made some months later at Kirkcaldy by the Central Board. Short circuits up to 992,000 kVA were cleared successfully in times varying from 1 to 2 cycles and short circuits up to 300,000 kVA in three-quarters of a cycle. Power was not available for larger short circuit tests, but it was obvious that the fuses were well within their capacity and showed no signs of distress with the largest short circuits.

The type " HR1 " fuse gave the best results. One of the novel features of this type of fuse is that a comparatively thin glass vent is used which fractures and relieves the pressure on the main tube under short circuit. For the horizontal " HR1 " fuses this vent is at right angles to the path of the arc and is mounted in an explosion chamber in the centre of the fuse. The blast from the extinguishing liquid and vapour rushes through the vent at right angles to the path of the arc. The glass vents were at the end of the two 66-kV fuses used in series on one test and not at right angles to the arc. These fuses cleared quite satisfactorily but with much more noise and obviously with less margin than the fuses with the gas blast at right angles to the arc.

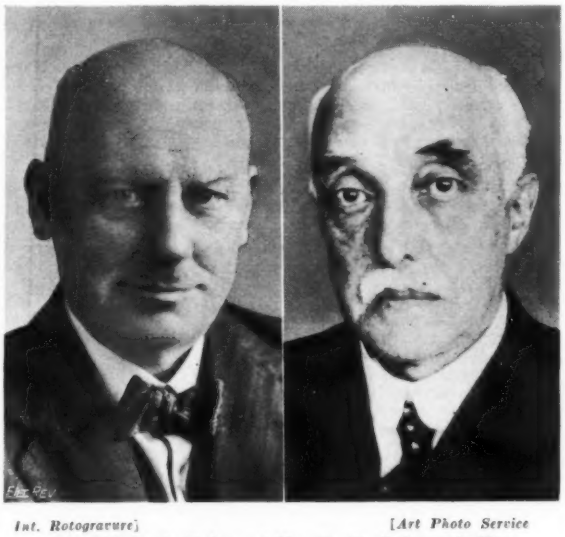
Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

New Year Honours.—The Honours List published on Monday last includes very few gentlemen connected with the electrical industry.

Mr. H. H. Dalrymple-Hay, M.Inst.C.E., consulting engineer, receives a knighthood for his inventions and services in connection with the construction of tube railways.

Sir Gilbert C. Vyle, managing director of W. & T. Avery, Ltd., and a past-president of the Association of British Chambers of Commerce, becomes a K.B.E.



Int. Rotogravure *[Art Photo Service*

Sir Gilbert C. Vyle and Mr. H. H. Dalrymple-Hay

Mr. W. D. MacGregor, M.I.E.E., Indian Posts and Telegraphs Department, lately Postmaster-General, Bengal and Assam, receives a G.C.I.E., and **Mr. A. R. Astbury,** C.I.E., Indian Service of Engineers, secretary to the Government (Electricity) and commercial manager, Hydro-Electric Branch, Public Works Department, Punjab, is given the C.S.I.

It is officially reported that although the American judicial authorities propose to contest the decision of the Greek Court of Appeal to refuse the application for the extradition of **Mr. Samuel Insull,** the Court's decision is final and there are no means for its reversal under Greek law.

Mr. L. H. Marlor, the installation engineer of the Manchester Corporation Electricity Department, was presented with a gold wristlet watch subscribed for by members of the staff of the Installation Section on December 19th, to mark the occasion of his completion of thirty years' service with the department. Mr. A. H. Fay, in making the presentation, referred to the excellent team spirit which prevailed amongst the staff under Mr. Marlor's control; these remarks being amplified by other members, to which Mr. Marlor, after thanking them for the gift, suitably replied.

Mr. L. H. Marlor

Sir Herbert Walker, general manager of the Southern Railway, has been confined to his room, and was unable to attend the inauguration by the Lord Mayor of the electrified line to Brighton and Worthing on December 30th.

Mr. W. D. Foster, control engineer to the Central Electricity Board at Welling, Kent, was recently married at Boston Parish Church to Miss Margaret Brudenall.

Mr. H. C. Reardon, who has retired from the staff of Mirrlees, Bickerton & Day, Ltd., of Stockport, after over twenty years' service, has been presented by his colleagues with a walnut sideboard.

Mr. Bancroft Gherardi, vice-president and chief engineer of the American Telephone & Telegraph Co., has, according to the *Electrical World,* been awarded the Edison Medal for 1932 by the American Institute of Electrical Engineers for his contributions to the art of telephone engineering and the development of electrical communication. Mr. Gherardi is a past-president of the American I.E.E.

Dr. W. R. Whitney, organiser and for thirty-two years director of the research laboratory of the American General Electric Co., retired from that position owing to ill-health on November 1st. He has been succeeded by **Dr. W. D. Coolidge,** senior associate director of the laboratory. Dr. Whitney continues as vice-president in general charge of research.

Mr. W. H. Redding, of Aldershot, who is on the staff of the Mid-Southern Utility Co., has been presented by his colleagues with an oak clock on his marriage.

Mr. C. James, district manager of the South Cumberland Electricity Co., has left St. Bees to take up a similar position at Carmarthen.

Mr. J. M. Walshe, A.M.I.Mech.E., has been selected from eighty applicants as assistant to the power plant manager at Apsley Mills, Hemel Hempstead. He received his training with Messrs. Bellis & Morcom, Ltd., and has carried out important contracts for that company at home and overseas

Mr. Max Falk, chairman of Falk, Stadelmann & Co., Ltd., was congratulated upon having completed fifty years' connection with the company at an informal gathering on January 2nd. Messages were received from a large number of managers and staff and district representatives. Mr. Falk, who received a gold cigarette case from his co-directors as a memento, still takes a very active interest in the business. He is in his sixty-seventh year.

Mr. Max Falk

Miss G. Clayton, who, as reported in our last issue, has taken up an appointment as demonstrator at Aylesbury Corporation electricity showrooms, was presented by the staff of the Banbury district office of the Shropshire Electric Power Co. with a writing set on her departure.

Mr. W. J. Rickets, A.M.I.E.E., formerly technical director of Alfred Graham & Co., Ltd., manufacturers of marine telephones and electrical signalling equipment, and of Graham Amplion, Ltd., electrical and radio engineers, has opened an office at Fearon House, 39, Holborn Viaduct, E.C.1, as a consulting inventor.

Obituary

Herr O. Engel.—The death is reported from Wiesbaden at the age of 61 years of Herr Otto Engel, who for a long period was connected with the technical division of the German Admiralty and played an important part in the introduction of electricity in German warships.

Mr. W. A. Shaw.—The death occurred on December 30th, at the age of sixty-eight, of Mr. William Albert Shaw, who was well known to a large section of our readers by reason of his activities in connection with the Electrical Contractors' Association, of which he was president on two occasions, 1912-13 and 1927-28, when he presided at the Cheltenham conference. In his address at this meeting he made a call for strong measures to suppress shoddy installation work, drawing attention to the inconsistency of demanding full protection from electrical accidents in the factory while condoning any sort of wiring work in the home.

The late Mr. W. A. Shaw

Mr. Shaw commenced business as an electrical contractor in 1886, being for some time in partnership with his brother, who later went to Cape Town. His earlier work was concerned mainly with mill lighting installations, and he also installed many private telephone systems for public authorities. His firm pioneered in street fire-alarm in-

stallations, and equipped several Lancashire and Cheshire towns in this way.

Mr. G. S. Kemp.—The death is reported of Mr. G. S. Kemp, which occurred at Southampton on January 2nd in his 76th year. Mr. Kemp, who was the Marchese Marconi's first assistant when the inventor came to England in 1896, spent his early days in the Navy, and was an instructor in electrical and torpedo work at Portsmouth. On leaving the Navy he became laboratory assistant to the late Sir William Preece, then chief engineer of the G.P.O., whose influence resulted in his association with Marconi. He worked with Marconi at the first demonstration of wireless telegraphy given to the officials of the Post Office, and in 1897 joined Marconi's Wireless Telegraph Co., Ltd., by whom he was employed on experimental and other work at many stations and laboratories. He was still associated with the company at the time of his death.

The late Mr. G. S. Kemp

He accompanied Marconi to Newfoundland in December, 1901, and he heard the wireless signals which the inventor succeeded in receiving from the high-power station at Poldhu, Cornwall — the first demonstration of trans-atlantic wireless telegraphy. His knowledge and carefully preserved records of Marconi's early work were accepted as being authoritative in the Law Courts—notably in the famous "Patent 7777" case in the United States of America, which established Marconi's claim to this basic wireless "tuning" patent. He lived to see the present network of wireless telephone and telegraph services spread over the whole world. During the last few months of Mr. Kemp's life Marchese Marconi and his assistants have been experimenting again with very short wireless waves of less than 1 metre wavelength, which was the order of wavelength used by Marconi in his earliest experiments and demonstrations when Mr. Kemp was his assistant.

Dr. G. Haret.—The death is reported of Dr. Georges Haret, the French radiologist, which occurred in Paris on December 21st. He had undergone many operations for burns received from X-rays, and was awarded the Cross of Officer of the Legion of Honour for his work.

Herr Ing. F. Fenger.—The death is announced, at Copenhagen, on November 29th, of Herr Ingeniör Fritz Fenger, who had been in charge of the Copenhagen branch of the Chloride Electrical Storage Co., Ltd., for the past twelve years.

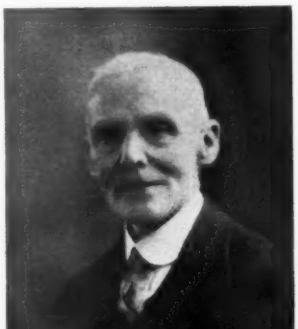
Capt. E. Szoets.—A *Reuter* message from Budapest reports the death of Captain Ernest Szoets, managing director of the Hungarian Broadcasting Corporation, and one of the pioneers of broadcasting, at the age of 48. Captain Szoets was responsible for many useful innovations and developments, and was the inventor of the so-called "conductor's cabin," in which the conductor is separated from the orchestra by a sound-proof glass wall and conducts by means of electrically operated signals.

Mr. H. W. Munro.—The death is reported of Mr. Herbert William Munro, chief electrician of the Aberdeen Corporation Transport Department, which occurred on December 29th. Mr. Munro had been in the service of the Aberdeen Corporation for twenty-four years, and was responsible for the reconstruction of the overhead tramway wires and for the whole wiring system.

Mr. H. Sherley-Price.—The death occurred at his residence at Beckenham on December 31st of Mr. Henry Sherley-Price, who in his early years at Manchester became proprietor of the engineering and auctioneering business of Wheatley Kirk, Price & Co. He took into partnership Mr. Wallis Goulty, a well-known engineer, and on the death of the latter the head office was moved to London, and so increased that his two sons and Mr. John Place joined him as partners and carried on in Watling Street, E.C. The services of the firm were requisitioned in many combines in which values fixed by his valuations became the basis for the accounts of the resulting amalgamations. Mr. Sherley-Price had been ill for some time. He was an early member of the Institution of Electrical Engineers, and was also a member of the Institution of Mechanical Engineers. The firm will be carried on as before by Mr. John Place and Mr. Horace Sherley-Price.

Mr. J. T. Baker.—The death is announced of Mr. John Thomas Baker, which occurred suddenly at his home in Hove on December 30th. Mr. Baker had been a director of Messrs. Page & Miles, Ltd., electrical engineers, of Brighton and Hove, for over twenty years, and had been connected with the company for over forty years.

Mr. A. E. Pullen.—The death took place at his home in Ealing, on December 22nd, of Mr. Albert Edward Pullen, who for thirty-three years was the chief assistant electrical engineer to the Ealing Corporation. Mr. Pullen had been in failing health for the last five or six years and retired from the service of the Corporation in February last at the age of 65. After serving his apprenticeship Mr. Pullen held appointments with Messrs. Wilson Hartnell, Leeds, and Messrs. R. E. Crompton & Co., Chelmsford. Later he became chief assistant with the Bournemouth and District Electric Light Co., subsequently taking up a similar position with Huddersfield Corporation. He left Huddersfield to join Mr. J. D. Knight, the electrical engineer at Ealing.



[Wakefields, Ealing

The late Mr. A. E. Pullen

Mr. G. P. Baldwin.—We learn from one of our American contemporaries that Mr. George P. Baldwin, a vice-president of the American General Electric Co., died suddenly on December 7th of pneumonia, in his 59th year. Mr. Baldwin was in charge of activities connected with the electrification of steam railroads.

Wills.—Mr. F. E. Elmore, A.M.I.E.E., metallurgist, left estate of the gross value of £56,382 (net personalty £49,185). He left £50 to the West Herts Hospital, and the residue, subject to further specific bequests, upon trust, part of the income to be applied to the provision of scholarships for medical research.

Mr. William Arthur Coulson, a director of Messrs. Mavor and Coulson, Ltd., and of Creed & Co., left personal estate in Great Britain of £25,538.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Speedy & Eynon, Ltd.—Private company. Registered December 24th. Capital £3,000 in £1 shares. Objects: To acquire the business of electrical and mechanical engineers and contractors carried on at 22, Essex Street, Strand, W.C., as "Speedy & Eynon." The life directors are: P. Speedy, "Lynton," Hemingford Road, North Cheam; and J. W. H. Hawes, 52, Avondale Avenue, Woodside Park, N.12. Secretary: G. L. Eynon, 72, Reigate Road, Ewell.

Bedford Battery Co., Ltd.—Private company. Registered January 2nd. Capital, £2,000 in £1 shares. Objects: To carry on the business of manufacturers and repairers of and dealers in electrical accumulators, &c. The directors are: G. Ayres, 123, Gladstone Street, Bedford, and V. E. Ayres, 234, Goldington Road, Bedford. Registered office: National Provincial Bank Chambers, 17, St. Paul's Square, Bedford.

"Quicksan," Ltd.—Private company. Registered December 23rd. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers, retailers and wholesalers of electrical, grilling and cooking apparatus, electricians, mechanical engineers, &c. The directors are: W. Supran, 21, Stamford Hill Mansions, Stoke Newington; G. W. Joyce, Westgrove House, Walton-on-Thames. Secretary: T. I. Scott Francis, 6, Old Queen Street, S.W. Registered office: Argyle House, 29/31, Euston Road, N.W.1.

International Resistance Co., Ltd.—Private company. Registered December 31st. Capital, £2,500 in 10s. shares. Objects: To carry on the business of manufacturers and repairers of and dealers in resistance material, glass rods and filaments, &c. The subscribers are: H. Pender, Dean Morie School, University of Pennsylvania, Philadelphia, Pa., U.S.A., and E. Gearing, 2005, Chestnut Street, Philadelphia, Pa., U.S.A. Secretary: B. S. J. Collins. Solicitors: Simons, 34, Great St. Helens, E.C.

City Accumulator Co., Ltd.—Private company. Registered December 28th. Capital £5,000 in £1 shares. Objects: To adopt an agreement with G. E. Ward, and to carry on the business of manufacturers of and dealers in electric accumulators and batteries, radio apparatus, &c. The directors are: G. E. Ward, 18, Dorset Chambers, Chagford Street, N.W.1; and W. H. Dunn, 25, Montagu Square, W.1. Registered office: 7, Angel Court, Strand, W.C.2.

Fattelay & Sharp, Ltd.—Private company. Registered December 24th. Capital £2,000 in £1 shares. Objects: To acquire the business of an electrical repairer and manufacturer carried on at Acton Street, Gray's Inn Road, W.C., by

A. D. Fattelay as "Fattelay & Woodhatch." The directors are: A. D. Fattelay, "Melbournia," 71, Orchard Way, Shirley, Croydon; and H. G. Sharp, 85, Harrow View, Harrow. Registered office: F. & S. Electrical Works, Acton Street, St. Pancras, N.1.

Raymond Gill & Co., Ltd.—Private company. Registered January 2nd. Capital, £1,000 in £1 shares. Objects: To adopt an agreement with R. Gill, trading as Raymond Gill & Co., and to carry on the business of engineers, agents and merchants formerly carried on by him at 92, Victoria Street, S.W.1, and that of suppliers of electricity, electrical manufacturers of and dealers in railway and other apparatus, &c. The subscribers are: R. Gill, Beech Coppice, Woodland Way, Kingswood, Surrey, and G. W. Mathews, 40, Hunters Grove, Kenton, Middlesex. R. Gill is the first governing director. Secretary, G. W. Mathews. Registered office: 92, Victoria Street, S.W.1.

Nulite Fittings, Ltd.—Private company. Registered December 31st. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical engineers and general electrical installation contractors, &c. The directors are: J. B. Hodgkiss, 243, Manchester Road, Swinton, Lancs, and G. Mottershead, 60, Bold Street, Hale. Solicitor: W. H. Eltoft, 41, Corporation Street, Manchester.

Returns of Electrical Companies

Calcutta Tramways Co., Ltd.—Capital, £1,400,000 in 700,000 preference and 700,000 ordinary shares of £1 each. Return dated May 17th (filed September 16th), 1932. 250,000 preference and 700,000 ordinary shares taken up. £764,900 paid (£1 per share on 250,000 preference and 409,100 ordinary, 14s. per share on 110,000 ordinary, 10s. on 40,000 ordinary, and 8s. on 22,000 ordinary). £185,100 considered as paid (£1 per share on 118,900 ordinary, 6s. per share on 110,000 ordinary, 10s. on 40,000 ordinary, and 12s. on 22,000 ordinary). Mortgages and charges: £350,000 1st debenture stock, and £212,900 2nd debentures.

Anglo-Portuguese Telephone Co., Ltd.—Particulars filed of debenture stock securing £400,000 (with liberty to issue further debenture stock, provided that the maximum principal amount at any time outstanding shall not exceed the nominal amount of the share capital, for the time being issued and fully paid up), authorised November 25th, 1932, and covered by trust deed dated December 16th, 1932, the amount of the present issue being £400,000. Property charged, the company's undertaking and property, present and future, including uncalled capital. Trustees: Westminster Bank, Ltd.

Griffin, Harding & Bryant, Ltd.—Capital, £3,500 in 2,000 preference, 1,400 ordinary, and 100 founders' shares of £1. Return dated October 26th, 1932. 1,184 preference, 1,400 ordinary, and 100 founders' shares taken up. £1,384 paid on the preference and 200 ordinary shares. £1,300 considered as paid on 1,200 ordinary and 100 founders. Mortgages and charges at date of return, nil. Since registered: 1st debenture, dated November 5th, 1932, to secure £1,500.

Edison Swan Cables, Ltd.—Debenture dated December 5th to secure £200,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Associated Electrical Industries, Ltd., Crown House, Aldwych, W.C.

Hastings & District Electric Tramways Co., Ltd.—Satisfaction in full on September 13th, 1932 (1) of two trust deeds dated January 20th, 1905, and March 20th, 1928, and registered January 28th, 1905, and April 10th, 1928, and (2) of trust deed dated June 15th, 1928, and registered July 3rd, 1928.

Chepstow Electric Lighting & Power Co., Ltd.—Satisfaction in full on December 16th, of debentures authorised October 29th, 1904, and registered October 20th, 1905, and December 2nd, 1920, securing £3,000.

Alger's Wholesale Supplies, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated December 7th, 1932, to secure all moneys due or to become due from the company to Lloyds Bank Ltd.

Scattergood & Johnson, Ltd.—Capital, £10,000 in 2,000 preference and 8,000 ordinary shares of £1. Return dated August 18th (filed September 21st), 1932. 7,928 ordinary shares taken up. £1,252 paid. £6,676 considered as paid. Mortgages and charges, nil.

Vaughan Crane Co., Ltd.—Capital, £150,000 in 50,000 preference and 100,000 ordinary shares of £1 each. Return dated September 14th, 1932. 16,880 preference and 53,578 ordinary shares taken up. £43,669 paid. £26,789 considered as paid. Mortgages and charges, nil.

J. W. Ray & Co. (Liverpool), Ltd.—Capital, £3,000 in £1 shares. Return dated September 24th, 1932. 2,753 shares taken up. £2,753 paid. Mortgages and charges, nil.

City Notes

Edmundsons' Electricity Corporation, Ltd., is calling for redemption on June 30th, 1933, its five per cent. debenture stock, of which there is outstanding £2,365,000. In connection with this the company is creating £2,500,000 of new four per cent. debenture stock redeemable 1950-1980, to be offered at £98 10s. per cent. Upon final redemption of the five per cent. stock the new stock will be secured by a first floating charge on the undertaking and assets of the company. Holders of the five per cent. stock are being invited, instead of waiting until June for their stock to be repaid at par, to surrender now the whole or any part of their holdings in exchange for an equal amount of four per cent. stock and a cash payment of £1 17s. 6d., representing the discount of £1 10s. on the new stock and interest adjustments up to June 30th next. In addition, although no issue of the new stock is being made to the public, holders of the five per cent. stock and the seven per cent. and six per cent. preference shareholders of the company are given the opportunity of subscribing in cash at 98½ for any part of the new stock which may not be required for the purpose of exchange. After the repayment of the five per cent. stock the principal of the new issue will be covered by the assets of the company over three times. The directors further state that they are satisfied that for the year ending March 31st next the earnings of the company available for the service of its debenture stock will cover the interest and sinking fund of the new stock not less than three times.

Yarrow & Co., Ltd., held their annual meeting on December 29th. Sir Harold E. Yarrow (chairman), who presided, before proceeding with the business of the meeting, referred to the death of his father, the founder of the company. Turning to the accounts, he said that, in spite of the continued depression in shipbuilding and marine engineering, they had been able to recommend a dividend of 5 per cent. on the ordinary shares, to place £10,000 to general reserve, and to carry forward rather more than last year. The Yarrow boiler continued to be largely adopted for both marine and land installations. Among recent orders received for the latter was a boiler installation for the South African Iron & Steel Industrial Corporation, Ltd., of Pretoria. The new Italian liner *Conte di Savoia*, was equipped with ten of the latest type of Yarrow high-pressure boilers, superheaters, and air-heaters, the drawings of which had been prepared by the company, the boilers themselves being built in Italy.

The British Vacuum Cleaner & Engineering Co., Ltd., reports a net profit for the year ended September 30th of £17,952, as compared with £14,982 in the preceding year. To this is added £8,415 brought in, and after placing sums to various reserves, it is proposed to pay a dividend of 12½ per cent. (same) and to carry forward £6,065.

Crompton Parkinson, Ltd., held an extraordinary meeting on December 22nd, at which resolutions were passed authorising an increase of capital by the creation of a further 173,231 6 per cent. cumulative second preference shares of £1 each.

The Young Accumulator Co. (1929), Ltd., reports a net loss to August 31st of £5,748 (against £22,034). At the annual meeting held on December 30th the shareholders agreed to reduce the capital of the company by writing off £150,000.

The Croydon Cable Works, Ltd., gives notice that on July 3rd, 1933, it will repay in cash all the debenture stock outstanding, together with interest and a premium of 5 per cent. on the capital sum. The amount of seven per cent. first mortgage debenture stock issued and outstanding is £65,000.

The Cape Electric Tramways, Ltd., has announced a dividend of 2½ per cent.

Stocks and Shares

TUESDAY EVENING.

THE opening of the New Year found the Stock Exchange Markets in a pleasantly cheerful frame of mind. It is quite true that most Stock Exchange brokers are greatly perplexed to know in what direction they shall advise investment of the money for which clients are constantly seeking employment. The brokers, and still more the clients, complain that prices of first-class ordinary shares have now reached such a level that the yield offered by the purchase of shares at to-day's prices is exceedingly small. The old cry of "Safety and five per cent." has gone by the board. In these days, Safety First is content with 4 to 4½ per cent. on the money, a rate which, when the 25 per cent. income tax is taken into account, leaves but a slender margin for living expenses. Nevertheless, the position is such at the present time that money is forced to accept this 4 to 4½ per cent. yield if it requires security without speculative risk, and the first problem of the New Year in the Stock Exchange is to discover suitable investments for the many who are to-day bringing their money for the purchase of stocks and shares.

The Diminishing Interest

The tendency nowadays is for companies and corporations to seek methods by which they can reduce their fixed-interest charges, and to substitute, for a high interest rate, some other stock that will cost them less. This is a following, of course, of the conversion of the five per cent. War Loan, where the majority of stockholders consented to accept 3½ per cent. instead of the 5 per cent. previously paid. Several cases have occurred recently, and one of the latest is provided by Edmundson's Electricity Corporation. The company has announced redemption of its £2,365,000 of 5 per cent. debenture stock, in place of which 2½ million pounds of new 4 per cent. debenture stock, dated 1950-1980, is to be created and offered at the price of 98½ per cent. If holders of the 5 per cent. stock consent to the scheme immediately, they can surrender their holding and receive, in exchange, an equal amount of the 4 per cent. stock, together with a cash payment of £1 17s. 6d. per cent. The holders of the company's 7 per cent. and 6 per cent. preference shares are offered subscription at 98½ of any part of the 4 per cent. debenture stock which may not be required for the purposes of exchange. Applications for the cash and conversion offers must be sent in not later than 10 a.m. on January 17th.

New Issues

Crompton Parkinson, Ltd., announced seven months ago that there would probably be a new issue of preference shares, and the hint has materialised into an offer of 6 per cent. cumulative second preference at 22s. The holders of the present 6 per cent. preference shares are to be offered the new issue, and any surplus shares not taken by them may be applied for by all the shareholders in the company. The present price of the preference shares is about 22s. 9d.

Of the other issues recently made, Electric Supply Corporation new shares have risen to 58s., Midland Counties Electric Supply debentures, after being 3½ premium, went back a trifle. County of London new shares are better at 49s. 3d. It is thought a number of public issues will be made in the near future by companies glad to take advantage of the opportunity now afforded for obtaining new capital upon moderate terms.

Home Railway Stocks

The Home Railway market has been cheered by a fairly general revival in shares of the coal, iron and steel group. Something in the nature of a mild boomlet has occurred in the latter, and this has found reflection in the Home Railway market. The traffics for the last week of 1932 show increases, but as the figures went against a short week in 1931, the traffics looked better than they actually were. The electric railway stocks have not participated to any noticeable extent in the improvements shown by the trade lines. Southern Railway stocks are in some favour by reason of the electrified service opened on Monday between London and Brighton.

Babcock & Wilcox at 2$\frac{1}{16}$ are the fraction better. Most of the issues in the iron and steel market have advanced during the past week. Vickers, for example, strengthened to 7s. 6d. Moreover, there is an active business being done in the popular shares.

Cables and Wireless

Freshened optimism has taken in hand the stocks of the Cables & Wireless group, and a number of favourable rumours are in circulation to account for the support accorded, more particularly, to the 5½ per cent. preference stock. Naturally enough, the first of these expectations is concerned with the possible resumption of regular dividend payments on this stock. Amongst others there may be quoted a somewhat unlikely report to the effect that a scheme is under consideration whereby the non-productive parts of the system which happen to be useful for strategical purposes will be subsidised by the Government. Anticipations of favourable results that may spring from the recent Madrid Conference play their part in fanning the bullish sentiment. A good deal of stock has been changing hands, and the ordinary issues are being bought by people who announce their intention of putting away the stocks for a year or two with the idea that both are likely to double in value. These impressions we repeat for what they may be worth, and in order to give holders of the stocks a comprehensive view of the reasons for the recent advance in prices.

With these stocks, Globe Telegraph & Trust ordinary and preference have improved. The prices stand at a common level of 11¼. American Telephone & Telegraph is 3 points up at 158½. Internationals, on the other hand, weakened to 10. Marconi Marines are somewhat neglected at 32s.

Electricity Supply

Metropolitan Electric ordinary shares are 6d. better at 2$\frac{3}{8}$ and City of London improved equally to 34s. 6d. Notting Hill Electric ordinary hardened to 38s. 9d. and North Metropolitan ordinary to 55s. 9d. In the suburban list, Richmond (Surrey) ordinary are a firm market at 49s. The provincial shares are generally hard, with improvements in Lancashires and North Easterns. Newcastle and District at 29s. 6d. are a shade better. Clyde Valleys slipped back to 31s. 3d., but Scottish strengthened to 35s. Central Electricity 4½ per cent. debenture is a point to the good at 105.

Atlas ordinary are 8s. 3d. and the preference 19s. 7½d. Calcutta Electric ordinary have gone up $\frac{1}{16}$ to 2½. Amongst the foreign issues, Tokyo Electric sixes put on a point, to 65. The abandonment of the gold standard led to a mild advance, to 78s. 9d., in Victoria Falls & Transvaal ordinary.

The Latin-American hydro-electrics, meanwhile, are moving in lackadaisical manner. Few people on this side of the Atlantic pay them much attention, and Wall Street remains in hesitating mood. Brazilian Tractions at 13¼ are ¾ higher. The market, like that for rubber shares, is idle and uninteresting.

Johnson and Phillips

Johnson & Phillips shares remain at 20s., unaffected by the proposal of the company to redeem, next July, the 6 per cent. first mortgage debenture stock then outstanding. The suggestion is to pay off, at 102, the £182,600 of this stock which will remain at that time, and to make an issue of £400,000 new 4½ per cent. debenture stock. Holders of the present stock will be given the offer of exchanging into an equal amount of the new. The premium of 2 per cent. will be paid in cash. The company states that the new issue will provide additional working capital for the purposes of the business.

The Manufacturing Group

In the search for good-class industrial investments, the shares of the electrical manufacturing and equipment companies are naturally scrutinised with close attention. The result of this is seen in rises of $\frac{1}{16}$ each in British Insulated, to 3$\frac{5}{16}$, Callenders to 3$\frac{3}{16}$, Enfields to 4½, Henleys to 6¼. Ever Ready shares are 6d. up, at 28s. 3d. Siemens have jumped a florin, to 27s. General Electrics are buyers at the middle price of 38s. 9d. Moreover, the shares of several members of this group are being vigorously tipped for higher prices.

Share List of Electrical Companies

	Nom.	Approx. Dividend. 1930.	1931.	Price, Jan. 3.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	70/6	—	4 4 9
Brompton Ordinary	1	8½	8½	33/6	—	4 3 7
Central Electricity 4½% Deb.	Stock	4½	4½	105	+1	4 5 9
Charing Cross Ordinary	1	8½	8½	33/6	—	4 3 7
Chelsea	1	8¾	8¾	33/–	—	4 4 10
City of London	1	10	10	34/6	+6d.	4 1 2
Clyde Valley	1	8	7	31/3	–9d.	4 9 7
County of London	1	11	10½	50/–	—	4 4 0
Edmundsons' 7% Pref.	1	7	7	30/–	—	4 13 4
Elec. Dis. Yorkshire	1	9	9	41/3	—	4 7 4
Elec. Supply Corporation	1	11	11	57/6	—	3 16 6
Kensington Ordinary	1	8	8	33/6	—	4 3 7
Lancs. Light and Power	1	6½	7	30/–	+9d.	4 13 4
London & Home Counties 4½% Deb.	Stock	4½	4½	107	—	4 4 0
London Electric	1	9	9	33/6	—	4 3 0
Metropolitan	1	10	10	47/6	+6d.	4 4 3
Midland Counties	1	7	7	33/3	—	4 4 2
Mid. Elec. Power	1	8	8	34/6	—	4 12 9
North Eastern Electric Ordinary	1	6	6	28/6	+6d.	4 4 3
Do. 7% Pref.	1	7	7	31/6	—	4 9 0
Northampton	1	10	10	48/9	—	4 2 0
Notting Hill 6% Pref.	10	6	6	12¾	—	4 14 0
North Met. Elec. 6% Pref.	1	6	6	29/–	—	4 2 9
St. James' and Pall Mall	1	8	8	33/6	—	4 3 7
Scottish Power	1	8	8	35/–	+⅛	4 11 5
South London	1	8½	8½	33/–	—	4 4 10
Urban Ordinary	1	7	7	33/9	—	4 3 3
Westminster Ordinary	1	8½	8½	33/–	—	4 4 10
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	16/3	—	9 4 8
Yorkshire Elec.	1	8	8	39/–	—	4 2 9
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	82½	—	4 17 0
Metropolitan	„	3½	2½	61	—	4 2 0
Do. District	„	5	4½	62½	—	7 4 0
Underground Electric	1	8	7	10/6	+6d.	7 3 7
TELEGRAPH AND TELEPHONES.						
American Tel. & Tel.	$100	9	9	158½	+3	5 13 7
Anglo-Am. Tel. Pref.	Stock	6	6	106½	—	5 12 9
Do. Def.	„	1½	1½	26	—	5 15 5
Cables & Wireless 5½% Pref.	„	5½	2¾	79½	+2	3 9 7
Do. A 7½% Ord.	„	—	Nil	29½	+2½	—
Do. B Ord.	„	—	Nil	12½	+¼	—
Globe Tel. and T. Ord.	10	8½	Nil	11¼	+½	—
Do. do. Pref.	10	6	6	11½	+¼	5 6 8
Great Northern Tel.	10	20	20	27½	—	7 5 6
Marconi-Marine	1	15	10	32/–	—	6 5 0
Oriental Telephone Ord.	1	12	12	2⅛	—	*4 1 8
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	—	—	3/3	—	
Do. do. 2nd Pref.	5	—	—	3/9	—	—
Do. do. 5% Deb.	Stock	—	—	7	—	
British Electric Traction Def. Ord.	„	5	5	265	—	—
Do. do. Pref. Ord.	„	8	8	132½	—	6 0 9
Brazil Traction	100	—	—	13¼	+¼	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	101½	—	4 18 6
London & Sub. Trac. 5% Pref.	1	Nil	Nil	11/6	—	—
London United Tram Deb.	Stock	4	4	65½	—	6 2 2
Mexico Trams, 5% Bonds	—	5	5	47/½	—	10 10 6
Mexican Light Common	100	Nil	Nil	10	—	—
Do. 7% Pref.	100	7	7	15	—	—
Do. 1st Bonds	—	5	5	70	—	7 2 10
Victoria Falls Ord.	1	15	15	78/9	+6d.	3 16 2
Yorkshire (West Riding)	1	Nil	Nil	5/–	—	—
MANUFACTURING COMPANIES.						
Assoc. Elec. Ord.	1	6	4	17/6	—	4 11 5
Do. Pref.	1	8	8	30/9	—	5 4 1
Babcock & Wilcox	1	14	14	41/3	+$\frac{1}{16}$	—
British Aluminium Ord.	1	10	5	23/9	—	4 4 0
British Insulated Ord.	1	15	15	65/3	+⅛	4 10 7
Brush Ord.	Stock	5	Nil	35	—	—
Callender's	1	15	15	3$\frac{5}{16}$	+$\frac{1}{16}$	4 14 1
Do. 6½% Pref.	1	6½	6½	28/3	—	4 12 0
Crompton Parkinson Ord.	5/–	30	24	20/9	—	5 8 6
Do. 8% Pref.	1	8	8	30/–	—	5 6 8
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	6 2 5
Do. 5% Deb.	Stock	5	5	100	—	5 0 0
Electric Construction	1	Nil	Nil	8/9	—	—
Enfield Cable Ord.	1	25	25	4½	+⅛	5 11 1
English Electric	1	Nil	Nil	10/–	—	—
Do. do. Pref.	1	Nil	Nil	15/–	—	—
Ever Ready	5/–	35	35	29/3	+6d.	6 8 5
Ferranti Pref.	1	7	7	21/6	—	5 14 3
G.E.C. Pref.	1	6½	6½	29/–	—	4 9 8
Do. ord.	1	10	8	38/9	—	4 2 6
Henley's	1	30	20	€¼	+⅛	4 18 0
Do. 4½ Pref.	5	4½	4½	5½	—	4 5 9
India-Rubber	1	Nil	Nil	2/6	—	—
Johnson & Phillips	1	10	5	1	—	5 0 0
Siemens Ord.	1	7½	7½	27/–	+2/–	5 11 1
Telegraph Construction	£1	Nil	Nil	16/3	—	—

* Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1931

16829. "Electrical signalling systems." Associated Telephone & Telegraph Co. June 18th, 1930. (Patent of addition not granted.) (384671.)

19446. "Battery terminal connectors." J. E. Hedges and J. Forsyth. July 6th, 1931. (384690.)

19694. "Telegraph signalling apparatus." Imperial and International Communications, Ltd., and H. V. Higgitt. July 8th, 1931. (384691.)

22430. "Electrical frequency responsive devices." W. G. Bird. August 7th, 1931. (384703.)

22793. "Electric cut-outs and controlling devices." British Thomson-Houston Co., Ltd., and L. Griffiths. August 12th, 1931. (384708.)

24098. "Electric signalling or indicating apparatus." Hopkinsons, Ltd., R. A. Hopkinson, and W. B. Dale. August 27th, 1931. (384713.)

25339. "Squirrel-cage rotors for induction motors subjected to axial vibration." Siemens-Schuckertwerke Akt-Ges. September 29th, 1930. (384719.)

26386. "Electrical measuring instruments." E. Reich. September 21st, 1931 (Convention date not granted.) (384727.)

27418. "Rheostats." F. Mackintosh. October 2nd, 1931. (384731.)

27635. "Apparatus for electro-massage." G. M. Chalmers, October 5th, 1931. (384733.)

27775. "Cells for the electrolytic treatment of fluids." A. E. Katz. October 6th, 1931. (384734.)

28140. "Electric starters for internal combustion engines." J. E. O. Louette. March 14th, 1931. (384739.)

29138. "Electric telecommunication systems." Lignes Télégraphiques et Téléphoniques." November 8th, 1930. (384747.)

29991. "Coin checking device for coin freed telephone installations." O. Moser. October 29th, 1931. (384752.)

31217. "Electric fuse elements and fuses." F. A. Ross. November 11th, 1931. (384766.)

31529. "Electric signalling apparatus for calling attendants." E. L. M. Van Gelder, Phœnix Telephone & Electric Works, Ltd., and L. V. Marks. November 13th, 1931. (384768.)

32291. "Police, fire, ambulance, and like telephone call systems." Ericsson Telephones, Ltd., P. Doig, E. Robinson, and B. A. Green. November 21st, 1931. (384773.)

32392. "Thermal protective devices for electrical apparatus." English Electric Co., Ltd., L. Roberts, and R. D. Ball, November 23rd, 1931. (384777.)

34140. "Electrical switches, particularly for use in wireless receiving apparatus." D. P. Wheeldon. December 9th, 1931. (384796.)

34717. "Telephone systems." General Electric Co., Ltd., and C. C. Puckette. December 15th, 1931. (384805.)

34875.—Electrical picture transmission apparatus." British Thomson-Houston Co., Ltd. December 16th, 1930. (384806.)

35045. "Mounting means for the operating lever or dolly of a tumbler switch." J. B. Tucker. December 18th, 1931 (Cognate application 259/32). (384807.)

35411. "Spring contact fingers for electric controllers and other like electrical apparatus." Electro-mechanical Brake Co., Ltd., J. Abberley, and P. T. Woodman. December 22nd, 1931. (384814.)

35740. "Liquid electric switches." Siemens-Schuckertwerke Akt.-Ges. March 11th, 1931. (384818.)

35749. "Electric switches, with arc extinction by self-generated vapour." S. Ruppel. December 24th, 1930. (384819.)

1932

1975. "Snap action electric switches." Wilmot-Breeden, Ltd., and H. J. Spicer. January 22nd, 1932. (384830.)

5265. "Electric tele-communication systems." Lignes Télégraphiques et Téléphoniques. March 14th, 1931. (384849.)

5825. "Electric power transmission systems." British Thomson-Houston Co., Ltd. February 26th, 1931. (384855.)

6310. "Speed controllers for electric motors." Igranic Electric Co., Ltd. March 2nd, 1931. (384860.)

7511. "Method of and apparatus for telemetering." Landis & Gyr Akt.-Ges. March 18th, 1931. (384865.)

8361. "Machines for covering electric wires and the like." Estler Bros., Ltd., and E. P. B. Estler. March 21st, 1932. (384874.)

9203. "Amplifying systems suitable for use in wireless signalling and for other purposes." Marconi's Wireless Telegraph Co., Ltd. April 9th, 1931. (384879.)

9410. "Electric motors." Sangamo Electric Co. January 8th, 1932. (384880.)

12151. "Single-phase induction motors." English Electric Co., Ltd., and R. D. Ball. April 27th, 1932. (384895.)

13323. "Terminal clamp for storage batteries having taper post terminals." G. R. Wilkins. May 9th, 1932. (384900.)

14724. "Cooling of the rotors of turbo-alternators." Ateliers de Constructions Electriques de Charleroi. June 5th, 1931. (384906.)

15460. "Electrical signalling systems." Associated Telephone & Telegraph Co. June 18th, 1930. (Divided application on 384671.) (384677.)

15946. "Transformer with adjustable stray reactance." Maschinenfabrik Oerlikon. June 25th, 1931. (384914.)

16438. "Differential condensers." Naamlooze Vennootschap Philips Gloeilampenfabrieken. June 12th, 1931. (384917.)

17791. "Dynamo-electric machines." J. Brazda. June 24th, 1931. (384924.)

21348. "Electric circuit-breakers." British Thomson-Houston Co., Ltd. July 28th, 1931. (Addition to 371340.) (384945.)

21484. "Overload circuit-breaker with thermal release device and variable resistance connected in parallel." W. Leyhausen. July 29th, 1932. (384946.)

21565. "Picture assembling devices for television receivers." Süddeutsche Telefon-Apparate Kabel und Drahtwerke Akt.-Ges. Tekade. August 5th, 1931. (384947.)

21566. "Television receiving apparatus." Süddeutsche Telefon-Apparate Kabel und Drahtwerke Akt.-Ges. Tekade. August 5th, 1931. (384948.)

22426. "Electric switches of the explosion pot type." International General Electric Co., Inc. August 10th, 1931. (384952.)

22880. "Synchronous electric motors." Ferranti, Ltd., and W. Holmes. May 1st, 1931. (Divided application on 12942/31.) (384681.)

22881. "Movable resistance contacts for electrical liquid level indicators." A. C. Spark Plug Co. August 13th, 1931. (384958.)

23152. "Control mechanism, particularly for use with electric switches." Westinghouse Electric & Manufacturing Co. September 10th, 1931. (384960.)

23514. "Electric condensers." Meirowsky & Co. Akt.-Ges. August 22nd, 1931. (384962.)

24841. "Arrangements embodying positive column electric gas discharge tubes for television purposes."' Fernseh Akt.-Ges. September 12th, 1931. (384965.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 28th :—

Acto. No. 533949. Class 8. Electric batteries and accumulators (not for medical purposes).—Atlas Supply Co., Wilmington, Del., U.S.A. (British representatives: D. Young & Co., 11-12, Southampton Buildings, Chancery Lane, W.C.2.)

Rainbow. No. 534981. Class 8. Radio signalling sound reproducers and amplifiers.—Anelays, 88, King St., Blackburn.

Ferrocart (lettering and design). No. 536229. Class 8. Radio-telephonic broadcasting apparatus and parts thereof.—Hans Vogt, Berlin. (British representative: F. H. Rogers, Bridge House, 181, Queen Victoria Street, E.C.4.)

Franklytic. No. 536827. Class 8. Electrolytic condensers (not for medical purposes).—Franklin Electric Co., Ltd., 150, Charing Cross Road, W.C.2.

Torribar. No. 535728. Class 13. Electric irons, soldering irons, water boiling utensils, coffee percolators, waffle irons, bed-warming appliances and immersion heaters.—Hotpoint Electric Appliance Co., Ltd., 24, Newman Street, W.1.

Electrical Contractors' Supplies for Argentina

THE Department of Overseas Trade has issued a report on this subject by the Commercial Counseller to H.M. Embassy, Buenos Aires, which states that generally speaking there are no wiring regulations in Argentina, an insulation test before connecting up being considered sufficient.

The majority of the companies supply three-phase a.c., and within a short time a.c. will be supplied by all stations. Outside Buenos Aires the cheapest wiring is the most popular, and this also applies to the sub-surface conduit which is generally light, cheap black enamelled iron piping with non-screw butt joints. No special provision is made for bonding or earthing systems outside the Federal capital.

In Buenos Aires, however, the Municipal Council's regulations make it obligatory for all electric wiring to be enclosed in a tube embedded in the wall, and the demand for tubing is appreciable. The three kinds most used are screwed tubing, ordinary heavy gauge (middle weight) equivalent to B.S.I. grade 1 conduit in standard lengths of three metres, which is chiefly imported from the United Kingdom; screwed tubing, extra heavy gauge, supplied almost exclusively by the United States; and light gauge screwed tubing which is practically all imported from Germany. The wire used is generally of the cheap kind, and lead covered wiring is seldom seen.

Distribution boards for small systems, ceiling roses, and switches are made of cheap materials, and tumbler switches are never seen except on British-owned railways. Two kinds of plugs and sockets are used—a popular and cheap type of base, and another type of heavy ebonite or rubber compound.

Electric shades and fittings are now a large local production; they are made efficiently and are cheaper than the imported goods. Lamps are nearly always of the metallic screw type, gasfilled ones being preferred. They are supplied chiefly by the large lamp makers, but a successful attempt to enter the market is being made by Russia with good lamps about 40 per cent. cheaper than combine products. A few companies use the bayonet type. Meters are chiefly supplied by United Kingdom manufacturers and to a small extent by Germany.

The report states that generally speaking electrical fittings manufactured in the United Kingdom are too good in quality and much too expensive for this market, apart from a few exceptional cases. There is no doubt that for Argentina and other South American countries United Kingdom standards are still too high, and the British manufacturer would stand an improved chance of selling his high quality product in this market if at the same time he turned out a cheaper article as well to compete with Continental goods. Meanwhile, the local industry in electrical goods is making big strides.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Large emporium for G. Hopkinson, Ltd., Nottingham; manager.

Aylesbury.—Houses (60); Taylor & White, architects, 7, Bourbon Street.

Ayrshire.—Reconstruction of soap works (£3,500), for J. Cowan & Co., Ltd., Irvine; the manager.

Barnsley.—Houses (50) for C. F. Napper.

Beadnell (NORTHUMBERLAND).—Hotel premises; Hicks and Charlewood, architects, 4, Mosley Street, Newcastle-on-Tyne.

Bembridge (I.O.W.).—Methodist Church (£2,500); trustees' secretary.

Bexhill-on-Sea.—Extensions, Devonshire Road, for Barclays Bank Ltd.; J. E. Maynard, architect.

Billingham-on-Tees.—School for R.C. Managers; correspondent.

Blackpool.—Houses (22), Rookwood Avenue; R. & H. Fletcher, Ltd., builders, Fleetwood Road, Cleveleys. Houses (25), Sandicroft Road; R. Fielding & Son, builders, Stanhope Road. Terrace of boarding houses, Queen's Drive, Bispham, for Mr. Pears (electric lighting); H. Best, 20, Clifton Street.

Bolton.—Houses (30), Devonshire Road; A. T. Reynolds & Co. Houses (25), Wheatfield Estate; W. Andrew, Ltd.

Bursiem.—Houses (56), Cobridge Road; Taylor, Shaw & Bromley. Extensions to pottery; Ellgreave Pottery Co., Ltd.

Chatham.—Houses (32), Symons Avenue site; R. L. Honey, borough engineer.

Cheam (SURREY).—Cinema; Bertram Williams. R.C. school; R. W. C. Crawford, St. Anthony's Hospital, North Cheam.

Corbridge (NORTHUMBERLAND).—Additions to Charlotte Straker Hospital; W. Dixon & Sons, 1, Collingwood Street, Newcastle.

Darton.—School; Trustees, Zion Methodist Church.

Dundee.—Six shops; A. Thain, builder.

Durham.—Extensions to Intermediate School, Seaham Harbour; Neat Bros., contractors, Houghton-le-Skerne.

Ealing.—Houses (44), Launceston Road and Torrington Road; Swannell & Sly, architects for Hillingdon Estate Co.

Easingwold (YORKS).—Alterations, Poor Law Institution (£6,900); county architect, Northallerton.

East Boldon (DURHAM).—Extensions, St. George's Church (£3,500); Wood & Oakley, architects, 9, Eldon Square, Newcastle-on-Tyne.

Eccles (LANCS).—Reconstruction of business stores, Church Street and Albert Street, for C. Miller, Ltd.

Edinburgh.—Additional storey, Grafton Assembly Rooms; Reid & Forbes, architects, 17, Great Stuart Street. Extensions, Heriot Watt College; city architect.

Elgin.—Improvements at Cathedral; burgh surveyor.

Epsom.—Block of shops, Manor Green Road East, for W. N. Crouch; H. Weston, architect.

Erith.—Houses (52); U.D.C. surveyor.

Essex.—School, Hornchurch; director of education, Chelmsford.

Falkirk.—Houses (£80,000); burgh surveyor.

Farnham.—Estate development, Longley Road; W. J. Wilkinson.

Glasgow.—Houses, Clarkston site; J. Laidlaw & Sons, Ltd. Greyhound track, Hawthorn Street; Possilpark & Springburn Greyhound Racing Co. Alterations and additions at Carntyne Racecourse, Parkhead, for Scottish Greyhound Racing Co., Ltd.; J. A. Johnston, architect, Troon. Extensions, police quarters (£4,000); city engineer. Reconstruction of works, Flemington Street, for the Craigpark Electric Cable Co., Ltd.; Wylie, Wright & Wylie, architects, 204, West Regent Street.

Gloucestershire.—Nurses' quarters, Standish House Institution; R. S. Phillips, architect, Shire Hall, Gloucester.

Guildford.—Rebuilding part of Council's offices at Millmead (£6,350); Council's surveyor. Swimming bath, Stoke Park (£12,999); borough engineer.

Hastings.—Business stores, Wellington Place (£7,000), for J. Sainsbury, Ltd., London.

Hornchurch (ESSEX).—Church (£8,000); J. Elliman & Son, Ltd., builders, Beckenham.

Irish Free State.—(BALLYBAY, Co. MONAGHAN).—Houses (20); F. Gibney, architect, 16, Westmoreland Street, Dublin. (CORK).—Schools, Bandon, and Macroom; D. J. Tierney, architect, 85, South Mall. (MULLINGAR).—Extensions to Mental Hospital (£110,000); B. Barrett, architect, 7, Upper Sherrard Street, Dublin.

Kenilworth.—Houses (20); S. Douglas, U.D.C. surveyor.

Kenley (SURREY).—Houses (42), Oaks Road; F. W. Thomas.

Kent.—School, Hawes Lane, West Wickham; county architect, Maidstone. Extensions, Dartford Institution, for the County P.A.C.; clerk, Maidstone.

Kiveton (SHEFFIELD).—Houses (30), South Anston (£8,186); Woodthorpe & Hanford (Worksop).

Leeds.—Shops (17), Harrogate Road, Moortown; E. Fish.

Lingfield (SURREY).—Houses (21), Newchapel; W. Spurrel.

Llandovery (CARMARTHENSHIRE).—College chapel; W. E. E. Anderson, architect, Cheltenham.

Lockerbie.—Cinema, with electrical work; J. Fairweather, architect, Glasgow.

London.—(CATFORD).—Houses (234), Burnt Ash Hill; A. J. Butcher. (EDMONTON).—Houses, Arterial Road (83) and Cambridge Road (47); G. W. Newman. Houses, Church Street Estate; Swannell & Sly, architects. Cinema, Silver Street; C. A. Aish, architect. Dairy, Oakthorpe Estate; London Co-operative Society, Ltd. Factory, Abbey Road; J. Neilson. Factory, Pretoria Road; Commercial Structures, Ltd., 38, Canal Road, N.1. Branch library, Houndsfield Road; U.D.C. surveyor. Nine shops, Bury House site; C. W. Hamilton. (HAMMERSMITH).—Five shops, Western Avenue; G. Whittaker. (POPLAR).—Factory, Old Ford Road; H. V. Kerr, 22, Old Buildings, Lincoln's Inn, W.C. (STOKE NEWINGTON).—Houses, St. Andrew's Road; G. K. Conrington.

Longbenton (NORTHUMBERLAND).—Houses (104); R. Carse and Sons, builders, Amble.

Maldon (ESSEX).—Houses (50); Tarslay (1923), Ltd., builders.

Maltby (YORKS).—Houses (36); Mollekin Bros. and J. H. Gilbert, Doncaster, builders.

Manchester.—Stores, workshops, and offices, Hamilton Road. Longsight, for E. Marks (electric lighting installations); H. Rhodes, architect, 90, Deansgate. Additions to school premises for the managers of St. Augustine's, Monsall, and St. Mark's, West Gorton (electric lighting); F. Thorpe, architect, Union Bank Chambers, Church Lane, Oldham.

Middlesbrough.—Houses (200), Brambles Farm and Whinney Banks Estates; S. Coates, Ltd., builders. Houses (22), Crescent Shaped Terrace; Archibald & Archibald, architects, 26, Albert Road.

Musselburgh.—Grand stand and totalisator for Musselburgh Race Course; burgh surveyor.

Mytholmroyd (YORKS).—Houses (24), Lower White Lee Estate; Hill Crest Building Co.

Newcastle-on-Tyne.—Houses, Rothbury Terrace, for A. E. Bedson & Sons; T. R. White, architect, Groat Market.

Northumberland.—Remodelling of girls' and' infants' school, Hexham-on-Tyne; W. W. Tasker, architect, 18, Claremont Place, Newcastle-on-Tyne.

Oxted (SURREY).—Development of estate for houses; J. Shaller Cowdrey.

Penrith.—School extension; Grammar School Governors.

Peterborough.—Hospital nurses' home for the P.A.C.; R. S. Jellings, Ltd., builders.

Richmond (SURREY).—Rebuilding business stores, with electric lifts, for Wright Bros., Ltd.

Rochester.—Houses (82); H. Newby, Ltd., builders, Ramsgate.

Rotherham.—Houses (29); R.D.C. surveyor.

Roxburgh.—Houses (35); county clerk, County Offices, Newtown Street, Boswells.

Rugeley (STAFFS).—Houses (33), Hagley Road site; U.D.C. surveyor.

St. Albans.—C.O.E. senior schools (£10,594); J. T. Bushell & Sons, builders.

Smethwick.—Extensions to hospital for Smethwick and Old bury Joint Hospital Committee; R. Fletcher, architect, Council House.

Southampton.—Houses (156), Coxford (£45,020); Wallis & Co., Wootton Bassett, Wiltshire.

Southend-on-Sea.—Church, Prittlewell; F. G. Harrod, builder.

South Shields.—Houses, Cleadon, for Sutton Trust (£125,000); C. S. Errington, architect, Grainer Street West, Newcastle-on-Tyne.

Stockport.—Works, Didsbury Road, Heaton Norris, for the Cheshire Sterilized Milk Co., Ltd.; C. Hartley, architect, Buxton Road.

Surrey.—School (384 places), Sutton; W. W. Finny, secretary, Kingston-on-Thames.

Sutherland.—School, Bonar Bridge (£9,000); county clerk, Dornock.

Swanscombe (KENT).—Houses (60); U.D.C. surveyor. Extensions to stores, High Street; Gravesend Co-operative Society, Ltd.

Swansea.—Stadium, Carmarthen Road; Swansea and West Wales Stadium Co. Additions to St. Mary's Convent, Convent Street; Rev. Mother Superior. Extensions, The Strand; Cambrian Cold Storage & Ice Co.

Taunton.—Houses (90), Lyngford site; borough surveyor. Tannery extensions, Tancred Street; French & Stenlake.

Tisbury (WILTS).—Church; Rev. Stanislaus St. John, Wardour Presbytery.

Tunbridge Wells.—British Legion headquarters; H. Elwig, architect, 25, Mount Ephraim Road.

Tunstall.—Houses (30), Queen's Avenue; Shaw, Taylor & Bromley.

Tynemouth.—Houses (96) and alterations to fire station; J. L. Beckett, borough engineer.

Wakefield.—Extensions to A. Haley & Co.'s mill; Newbold & Hartley, architects, Crown Court.

Walker-on-Tyne.—Houses (60); W. Leech, builder, Coutts Yard, Newcastle.

Wallasey.—Greyhound track, Dock Road; W. D. Forbes.

Wallington.—R.C. school; Rev. J. Torrance, 118, Stafford Road.

Waltham Abbey.—Houses (62), Sewardstone Road site; U.D.C. surveyor.

Wednesbury.—Alterations, King's Hill infants' and junior school (electric lighting); Joynson Brothers, architects, Lower High Street.

Wellingborough.—Offices for the Express Transport Service, Debdale Gardens, Compton Road. Additions to factory premises for R. Thompson, Ltd., Park Road.

Wembley.—Houses (54); Leightons (Contractors), Ltd., Lowestoft.

West Bromwich.—School, Friar Park; director of education.

West Riding.—School, Wrangbrook (£12,650); county education architect, Wakefield.

Wolverhamoton.—Houses (218), Elston Hall Estate. Bushbury; A. J. Fieldhouse. Houses (50), Low Hill Estate (£14,300); A. M. Griffiths & Son, Ltd. Congregational church and school, Blakenall; A. Powell. Rosegarth, Chetwynd Road. Foundry extensions, Bloomsbury Street; C. & B. Smith. Offices (£6,298), for Freeholders' Permanent Building Society; H. J. Amies and Sons, builders.

Worksop.—Church, Langold; Rev. Canon d'Arcy, the vicarage.

York.—Development of Osbaldwick and Burnholme Estates; Cowling & Swift. Rehousing, Navigation Road area; city engineer.